WORLD PETROLEUM

NOVEMBER 1957

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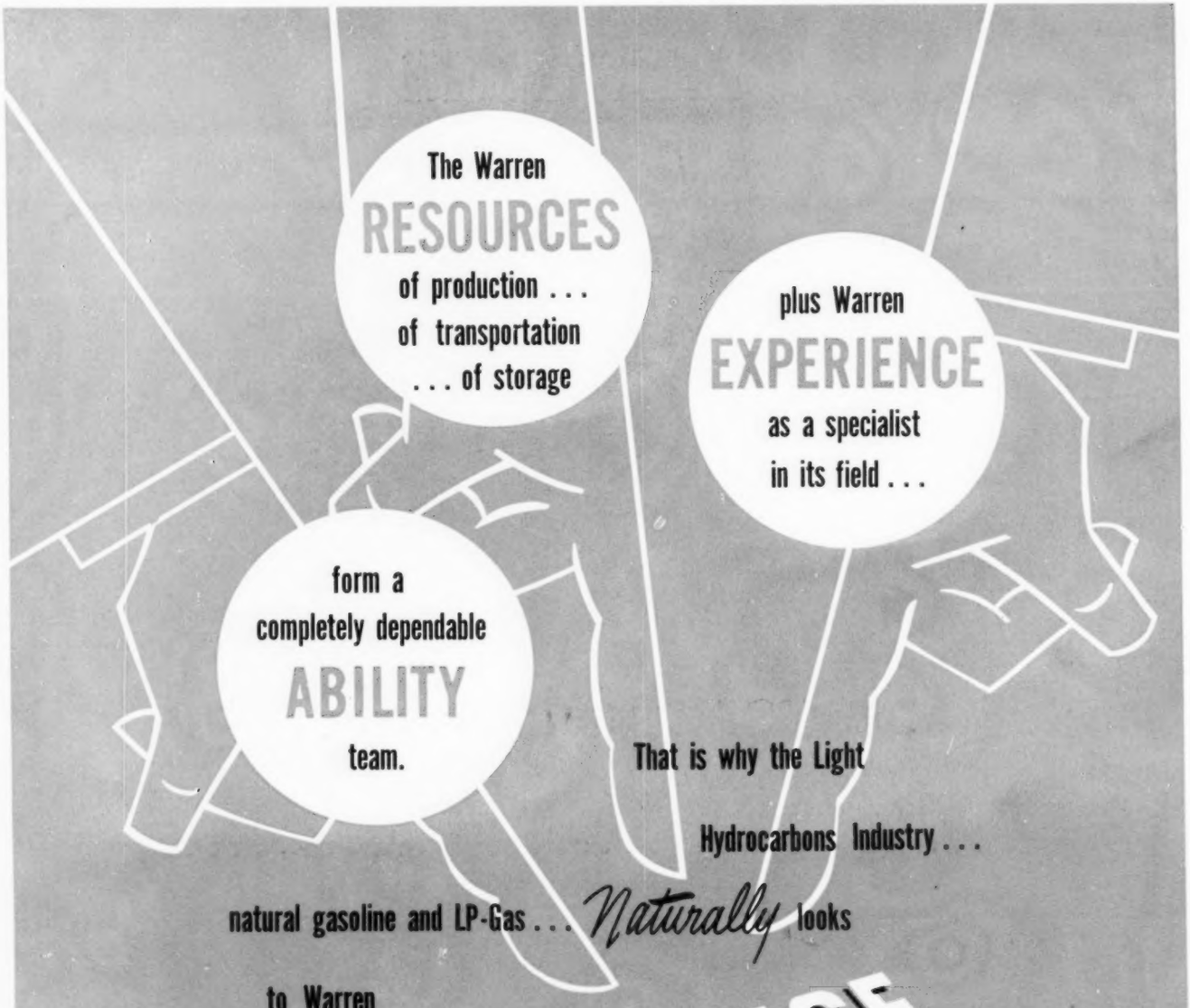

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VOL. 28, NO. 12 NOVEMBER, 1957

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

Members of a drilling crew disembark from a helicopter for a 40-hour tour of duty on a Humble Oil & Refining Co. offshore drilling rig off Grand Isle, La., in the Gulf of Mexico. Humble now uses 11 helicopters compared with one in 1954. Color plates are reproduced through the courtesy of the editors of The Humble Way, house magazine of Humble Oil & Refining Co.

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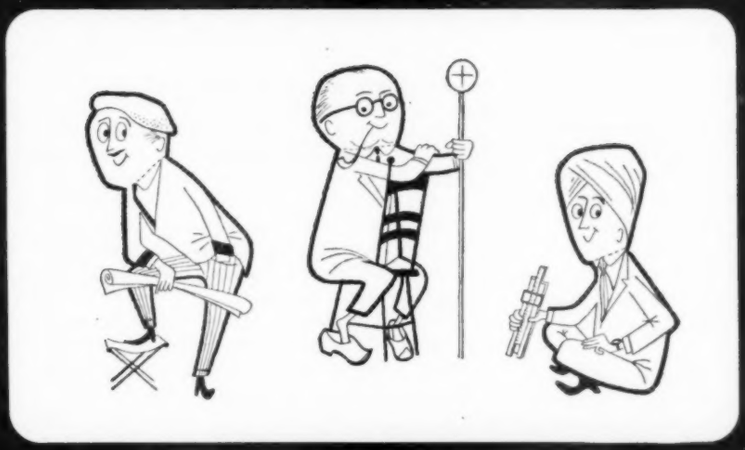

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Washington PIPE LINE

By Joseph Huttlinger

A peek at oil expansion plans outside the United States is being furnished as oil companies tell U.S. officials how much crude oil they plan to bring to the United States.

Standard Oil Co. (Ind.), which has no interests in the Middle East, is interested in developing crude oil "wherever we can find it economically," said John E. Swearingen, executive vice-president. He was answering a question about company plans for Middle East. Indiana now is in Venezuela.

Standard Oil Co. (Ohio) has "long range" ideas about a crude oil pipe line from the U.S. East Coast to its Ohio refineries to bring in crude oil. But this would only be when "volume of imports is sufficient to make it economical," it was explained by Richard C. Sauer, vice-president for supply and distribution.

Now, Ohio imports crude from Venezuela and the Middle East, turns it over to an East Coast refiner, and receives U.S. crude oil in return. Idea is to make money, Ohio frankly says. The imported oil can be landed at the East Coast at 50 cents and more a barrel below cost of U.S. crude.

Sinclair Refining Co. let loose the news that its new pipe line for crude oil in Venezuela could be "easily" stepped up to 300,000 b/d capacity. Most reports refer to the initial capacity, as the line opened Oct. 15, of 100,000 b/d. Line means an outlet for crude output in the Barinas area. J. E. Dyer, president, passed out the information, adding Sinclair expects to have 46,000 b/d of production in the area soon after the line gets into operation. Sinclair is one-fourth owner of the line. Socony Mobil Oil Co. has the rest.

Tidewater Oil Co., finally, is basing bulk of its future expansion on imports of crude oil, much of it from Getty Oil Co., operating in neutral zone of Kuwait-Saudi Arabia. Company feels the security for the U.S. is oil imports.

Finally, one oil company president says the chief reason why U.S. drilling lags is that U.S. independent producers are going abroad to look for oil, giving a larger slice of drilling budgets to foreign operations. Other reasons are general decline in the economy, surplus crude and products, weather, tight money, shock of Suez which brought overbuilt U.S. industry.

Isotopes Save Oil Money

The American petroleum industry is saving about $178 million a year by the use of radioisotopes, says Dr. W. F. Libby a member of the U.S. Atomic Energy Commission. Their use is due to increase tenfold during the next five years.

Disclosing results of an AEC survey of the business community, he said industry as a whole saves about $406 million a year by using the isotopes as traces, in gages and the like. For oil, the savings, with one low and one high estimate, are as follows (in millions of dollars):

	Low Estimate	*High Estimate*	*Average*
Oil well logging	$ 16.0	$ 24.0	
Oil well stimulation	120.0	180.0	
Pipeline flow	0.5	0.7	
Petroleum refining	5.3	10.1	
Total	$141.8	$214.8	$177.8

For comparison, a similar study in 1953 found savings at that time of $100 million a year by industry. For petroleum industry, the savings were only $5 million.

O'Mahoney Minority

The O'Mahoney report on the oil for Europe program was quoted around the world for a variety of reasons, but the report is probably most significant because it represents one of the smallest majorities of a committee of this kind within recent memory. Only two members of the Senate Judiciary subcomcittee signed it—Senators Joseph C. O'Mahoney, D., Wyo., and Estes Kefauver, D., Tenn. They found oil guilty of many things, and asked studies towards higher taxes, a crackdown on pipe lines, and of Arabian-American Oil Co. The report had no good word for oil.

Sen. Everett M. Dirksen, R., Ill., found oil blameless, in a point by point answer to the majority report. Sen. Alexander Wiley, R., Wisc., in a second minority report, sided with O'Mahoney on some points and with Dirksen on others, and threw in his own views in addition.

Thus, there were four signers of the report, who split two-one-one, although the oil for Europe study began under two subcommittees of the Senate with a total of 16 members. A true majority report, thus, would have required nine signatures.

Along the way, the Senate Interior subcommittee members dropped out, and many of the Judiciary subcommittee members showed little interest in the hearings at all.

As a result, the report is likely to carry little weight either with the Congress or the U.S. government agencies. What effect it will have over the world, where persons may not understand the free give and take of charge and counter-charge that makes up American politics, is to be seen.

Canada Puts Tariff On Oil Pipe

Canada has advised the U.S. State Department and others she may raise the import duty on pipes and tubes for oil and gas operations. Under the General Agreement on Tariffs and Trade, countries may raise certain import rates on Jan. 1, 1958. U.S. has asked industry for its views on the impending action.

Materials in which Canada is interested in changing the import rates are listed as: "Pipes, tubes, pipe fittings and couplings including casings for use in casing water, natural gas or oil wells and pressure pipe for pipe lines, as well as pipe and valves used in drilling for water, natural gas or oil, or in prospecting for materials."

The action is in line with the "Canada-first" attitude of the new Prime Minister, Mr. Diefenbaker. He wants more control over Canada's oil industry by Canadians, as well as more profits for Canadians. He sees "disquiet" over U.S. interests having control over 60 per cent of Canada's manufacturing industries, and more than this share of control over oil and gas.

Specifically, he asks "full account" be taken of the interest of Canadians in using that control, that U.S. firms in Canada incorporate in the northern country, and that they sell equity stock to Canadians. Not more than one in four of the U.S. firms in Canada, he feels, offer stock to Canadians.

Canada imported $82 million worth of these commodities during 1956, the vast bulk from the U.S. The import rate varies by the specific commodity, but it is 15 per cent ad valorem on pipe and tubes of steel, welded, more than 10.5 inches in diameter. Canada imported some $48 million worth of this in 1956, of which $41 million worth came from the U.S.

Product Imports May Be Limited

The Oil Import Administrator, Capt. M. V. Carson, may recommend restriction of residual and other refined imports. This is the first time the government has moved outside of crude, and it is designed to remove the possibility of circumventing the crude restrictions by residual and other refined imports, which are not included under the present agreement under discussion.

He stated a program similar to that for crude would be imposed if necessary. This was after the second round of imports estimated for September to January showed an average of 834,000 b/d of crude. This is still about 80,000 b/d higher than the government wants it to be.

At recent hearings seven of the companies asked for higher quotas and one, Sun Oil, refused to go along with the program for anti trust reasons, although gradually reducing its imports anyway. Hardest hit are two companies which have major installations newly built depending on the U.S. import market. One is Sinclair who (with Socony) have just completed the 100,000 b/d Barinas pipeline in Venezuela. It opens up a new producing area for them but they may not be able to use it fully if the market on the U.S. East Coast is closed. Tidewater has its new $130 million refinery at Delaware, dependent on crude supplies from the Middle East, but is now caught under a low import ceiling because the company held imports down till recently when the refinery was complete.

LOW DOWN . . . The low, sleek lines of the modern American automobile are made possible by an ingenious engineering achievement called the hypoid gear. It drives the rear wheels, but because it meshes *below* their centers, engineers are able to reduce an automobile's height. Lubricating the hypoid gear posed a tough, complex problem . . . a problem eventually solved by the combined research skill of the automobile and petroleum industries. Texaco scientists pioneered in developing a rugged petroleum lubricant for this special purpose . . . another evidence of the cooperation and resourcefulness that has made Texaco research a valuable partner of modern industry in its march of progress.

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Canadian Notes

Alberta & Southern For Gas

Alberta & Southern Gas Co. Ltd. is name of new Canadian-American company to pipe gas 1,300 miles from Alberta to northern California. Seven Canadians and six Californians are on board. Shell has contracted to supply 200 mmcf per day, half initial requirements.

Imperial Posts Crude Decrease

Imperial Oil Ltd. has posted 4-cent decrease for western Canadian light crudes to equalize decline in American currency and preserve competition in Ontario market.

Alaska Bidding Active

Richfield's strike at No. 1 Swanson River has set off concession rush. Well came in at 11,040 ft to 11,170 ft at about 200 b/d.

Trans-Canada Line Delayed

It is understood that work on the Trans-Canada natural-gas pipeline—including the remaining half of the Crown-owned lease section across northern Ontario—will be divided among nine spreads next year. Meanwhile, the four contractors on the Crown lines are losing a nip-and-tuck battle with weather, swamps and muskeg, and hard granite rock—with little chance of completion by year-end.

Canadian Gas Contract Signed

Shell Oil Co. has signed a long-term contract with Alberta & Southern Gas Co. for all the natural gas it may discover in southern Alberta in the next 10 years—up to five trillion cubic feet. It is the first allocation of reserves yet to be discovered, and indicates a high appraisal of the future northern California market—destination of gas through the Alberta & Southern proposed big-inch line.

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Alberta Allowables Overhauled

Alberta Conservation Board has overhauled its whole rule structure for monthly allowable crude production in the western Canadian province. First stage—January 1, 1958—will lower minimum initial allowance by 4 b/d to 30 b/d, increasing according to well depth. Second stage—deferred two years—will put all proration above the minimum initial allowance on almost a straight MER basis. This will give advantage to major field wells and provide higher incentive to efficiencey.

New Canadian Refinery Planned

A refinery of around 40,000 b/d capacity is reportedly under consideration by Irving Oil Co., a local marketing concern, and two major oil companies. Location would be on tidewater at St. John. Distribution of products would be through the Maritime provinces and eastern Quebec.

Alberta Allowables Tight

Alberta allowable of 347,000 b/d for September, lowest since spring of 1956, is symptom of West Coast export squeeze and growing Saskatchewan market. Forecasters now look for 1½ to 2 years of very tight allowables, as domestic markets are leveling off for Alberta producers and new export markets within economic range as far away as summer of 1959 for nearest visible date.

Westcoast Ups Financing

Further financing is being planned by Westcoast Transmission Company Limited, with a view to handling capital expenditures for enlargement of the system to move 650 mmcf/day instead of the present maximum throughout capacity of 400 mmcf/day. Development of the Pacific Northwest market at a phenomenal rate is understood to be the factor responsible for prospective business rise.

Markets For Canadian Oil

An industrial tour providing a first-hand look at Canada's oil and gas industry was staged in September, by the Toronto Stock Exchange for senior partners and officials of Toronto Stock Exchange member firms. More than 100 persons representing leading financial houses in Canada, the United States, England, and Free China made the tour.

A. G. Bailey, vice president and general manager of Bailey Selburn Oil and Gas Ltd., estimated that $400 million will be required in Alberta alone to the end of 1962 for drilling, plants, and gathering and transmission systems to carry out present export plans. Money for main transmission systems was not included.

Bailey said: "A year ago our gas was worth about 10 cents at the field gate, and we are now being offered as high as 14 cents at the well head. This is an increase of over 50% in a short time . . . New contracts being offered give the producer fairly good escalation benefits, renegotiation and favored-nation clauses, with prices escalating to 18 cents or better by 1967. This compares favorably with going prices, south of the border."

R. A. Brown, Jr., president of Home Oil Ltd., aired a protest in regard to markets for Canadian oil. He stated that "it would seem logical that now is the time for Canada to work out an overall energy policy and to work with the United States authorities to devise a formula which also includes the marketing of our surplus oil." Mr. Brown called attention to the tariff on Canadian oil, stating that it is not in the best interest of either the United States or Canada that Canadian oil is required to absorb a 10-cents-per-barrel tariff. He continued: "Through the search for oil, gas is discovered and some formula must be worked out that will permit the orderly marketing of both these products, not just one of them—namely gas . . . We must view our energy assets on a continental basis recognizing our close relationship with our neighbors to the south and the fact that much of our oil and gas development has taken place under their leadership both with personnel and with very large investment."

Light Oil Near Wapella

Saskatchewan Department of Mineral Resources has announced discovery of an important new light-oil pool 12 miles east of the town of Wapella. Located in the Bakken formation, the 38 API oil discovery was made by the pumping of the Riddle-Tidewater-Rocanville-Crown 16-32 wildcat well at approximately 35 b/d. Drilling operations were begun, July 15. Following resulting oil shows from a drill-stem test, production casing was run on August 18 to further evaluate the well. On August 23 it was placed on pump.

The well is situated eight miles from the Wapella field, which is producing oil from the Blairmore and Jurrassic formations. It is the third Bakken formation discovery in the province. The other two are located near the town of Roncott, 200 miles to the southeast, and at Coleville. A follow-up well will be drilled to continue evaluation of the formation.

First Canadian BTX Plant Onstream

Canada's first plant for producing chemically pure benzene, toluene, and xylene from petroleum has gone into operation at the Sarnia, Ontario, refinery of Canadian Oil Companies Ltd. The three aromatic hydrocarbons are being produced in an integrated UOP Platforming-Udex extraction unit which went onstream recently. The unit completes a $3 million program to expand the company's petrochemical manufacturing facilities. Platformer has a design capacity of 4,400 b/d. It is being operated exclusively to produce charge stock for the Udex facility. Neighboring chemical plants already have contracted for the total benzene output, and the other aromatic products, toluene and xylene, presently are being used in motor fuels.

Many Island-Hatton Joint Pool

Issue of a permit by Alberta Conservation Board to Saskatchewan Power Corp. for removal of 86 mmcf per day average of gas from Many Island field in eastern Alberta will permit start in fall of 1958 on full development of this and Hatton field on Saskatchewan side, constituting joint pool. It will make SPC independent of Trans-Canada, which is supplying Regina for initial heating season of 1957-58.

Refueling For Polar Flights

Imperial Oil Ltd. is rushing tankage facilities and aviation gasoline to remote Frobisher Bay on Baffin Island in the eastern Arctic, refueling stop and halfway point for the newly designated polar air route to Europe. The company will install a 96,000 bbl aviation-fuel tank and hydrant system to service intercontinental air-cruisers touching down at Frobisher on their way to the European capitals from major USA cities on the Pacific Coast.

Both Pan American World Airways and Trans World Airways expect to have a regular passenger service across the roof of the world. Four other major airlines have indicated strong interest in the route.

Frobisher's strategic importance as an airfield site was first realized during World War II, when it was built by the US Air Force as a refueling stop for military planes evacuating US casualties from Europe. After the war, the Canadian government purchased the air installations from the United States for $6,800,000. The airport is 1,287 miles north of Montreal.

Interprovincial Line Extended

A 156-mile addition to the world's longest crude-oil pipeline has been completed, and oil already is moving into this 20-in. of Interprovincial Pipe Line Co., which extends from Sarnia to Port Credit, Ont. It is expected that Western Canadian crude oil was to have been delivered to the British American refinery at Clarkson, Ont., about Oct. 1. Deliveries to Regent Oil refinery in Port Credit were scheduled to start November 1. Prairie oil now flows 1,931 miles through the major oil artery of Interprovincial from fields in Alberta, Saskatchewan, and Manitoba to markets in the east.

BP AND THE GEOPHYSICAL YEAR

ALL PETROLEUM PRODUCTS for the Commonwealth Trans-Antarctic Expedition have been supplied by The British Petroleum Company.

In addition to large quantities of lubricating oil, 82,000 gallons of fuels of various kinds have been shipped in the "Theron", "Endeavour" and "Magga Dan". A member of BP's geophysical staff has been attached to the expedition to carry out scientific observations during the crossing of the Antarctic Continent.

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News on Ethylene from England

Imperial Chemical Industries Ltd., the largest chemical manufacturing firm in the British Commonwealth, is meeting the increased demands for ethylene-derived products with a third ethylene manufacturing plant in northeast England. As the discoverer and a major producer of polyethylene, I.C.I. consumes large amounts of high purity ethylene.

The M. W. Kellogg organization was privileged to engineer I.C.I.'s first two ethylene plants. Kellogg is completing the engineering of the third plant, and has started construction. All three plants utilize the unique Kellogg steam-cracking process which produces exceptionally high yields of over 99% pure ethylene with a high on-stream efficiency.

The close cooperation and interchange of technology between I.C.I. and Kellogg will assure the success of this new plant as it did for the two now in operation. Kellogg's ability to work closely and harmoniously with chemical companies is largely responsible for the organization's leading international position in petrochemical engineering.

The M. W. Kellogg Company welcomes your petrochemical inquiries.

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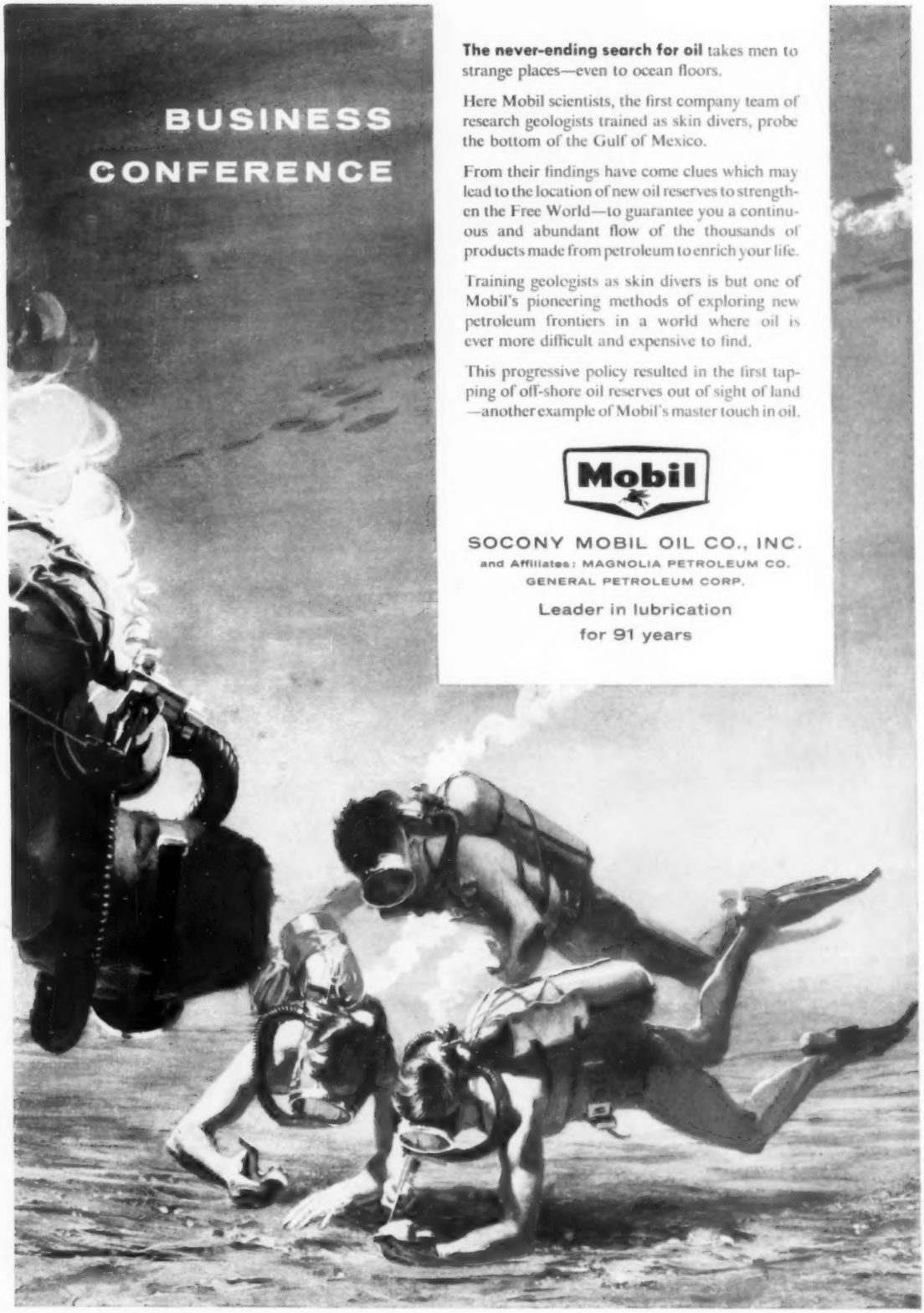

The never-ending search for oil takes men to strange places—even to ocean floors.

Here Mobil scientists, the first company team of research geologists trained as skin divers, probe the bottom of the Gulf of Mexico.

From their findings have come clues which may lead to the location of new oil reserves to strengthen the Free World—to guarantee you a continuous and abundant flow of the thousands of products made from petroleum to enrich your life.

Training geologists as skin divers is but one of Mobil's pioneering methods of exploring new petroleum frontiers in a world where oil is ever more difficult and expensive to find.

This progressive policy resulted in the first tapping of off-shore oil reserves out of sight of land —another example of Mobil's master touch in oil.

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London Letter

By E. Lawson Lomax

Straddle Carriers

The British Straddle Carrier Co. Ltd. has developed a model for handling pipes up to 96 ft. long and 27 in. in diameter, and stringing them ready for pipelaying and welding. The unit is powered by a Perkins P-6 industrial-type diesel engine.

Equipment Orders April-June

Council of British Manufacturers of Petroleum Equipment has issued its report of orders for materials and equipment placed in the United Kingdom by oil companies during the second period (April-June). Total amounts to £29,944,395, against total £36,282,900 same period 1956—making a total of £65,944,098 for first half of year. The drop of £6,338,505 compared with same 1956 period—although high—is not quite so serious as it appears because the same period of 1956 was quite exceptional. Actually, the figure for 1957 is higher than for any similar period in all the recorded years, except 1956. At present there appears to be somewhat of a lull in various sections of the industry which does not appear to have, as yet, shaken off the effects of the Suez crisis. Following tabulation gives details of the various orders compared with 1956:

	1957 (Pounds Sterling)	1956 (Pounds Sterling)
1. Geophysical and other exploratory equipment, etc.	14,061	42,513
2. Specialized equipment for oil drilling and production—including oil casing, tubing, etc.	4,552,068	3,650,585
3. Specialized equipment for oil refineries (not including pumps and valves)	735,339	752,055
4. Drums and can making, filling, and cleaning equipment; curbside pumps and other oil-metering and dispensing equipment	162,447	214,418
5. Rail cars, road tankers, aircraft refuellers, etc.	3,887	40,016
6. Tankage—including tank fittings	586,191	2,926,818
7. Drums, drum sheets, and tinplate	1,137,401	1,726,718
8. Tubulars, pipe fittings, and valves (ferrous and nonferrous)	5,147,192	8,064,122
9. Pumps (excluding slush, oil-well and curbside)	553,719	486,010
10. Boilers, boiler-house plants and accessories, etc.	29,173	55,958
11. Electrical equipment—motors, generators, transformers, etc.	2,125,037	1,908,532
12. Instruments, meters, gauges, etc.	413,186	387,773
13. Prime movers and compressors	644,682	888,072
14. Machine and hand tools, welding, and miscellaneous machinery and stores	2,696,570	2,587,266
15. Ferrous and nonferrous plates, sections, sheets, and bars	2,120,977	1,665,605
16. Automotive equipment—all types	1,816,862	1,761,068
17. Laboratory equipment and chemicals—including hospital and medical supplies	255,886	255,323
18. Bulk chemicals, catalysts, barytes, etc.	4,567,114	5,475,018
19. Cement and other building materials and hardware—including timber.	856,724	1,612,462
20. Commissary, general requisites for office, warehouse, household, clubs and sports, etc.	1,525,939	1,782,468
Total	29,944,395	36,282,900

D. G. Smith

54-In. Valve for Calder Hall

A new 54-in. fullway valve has been designed and fabricated by Davey Paxman & Co. Ltd., for use in the Calder Hall nuclear power station. It is constructed in BSS-14 steel to Lloyds Class I requirements for working pressures of 125 psi at 700 F, and has been developed from cast-steel valves already supplied to the station by J. Blakeborough & Sons Ltd.

Union Carbide Ltd. Extends Petrochemical Activities

Esso Petroleum Co. Ltd. and Union Carbide Ltd. have announced that the latter is to build a plant, on a 52-acre site adjacent to Fawley, for the manufacture of a number of ethylene-oxide derivatives. The ethylene required for this plant will be drawn from the £9 million chemical plant now being erected at Fawley by Esso for the supply of raw materials to the British chemicals industry. The new Union Carbide plant is estimated to cost about £3 million, and is scheduled for completion in 1959. This is the second major chemical plant under construction in the UK by Union Carbide—the other being a polyethylene plant at Grangemouth, Scotland, which is scheduled for completion in October of this year.

Lithium-Based Greases

The multi-purpose properties of lubricating grease based on lithium 12 hydroxy stearate have become well-known to industry over the past seven years. Since the introduction of Shell Alvania greases, which have been protected by worldwide patents in the UK since 1950, further research and development by Shell at the Thomton Research Center has led to the inclusion in the new greases of a new powerful corrosion inhibitor which confers outstanding anti-corrosion properties even in the presence of large quantities of water. The oxidation stability of the greases has been improved, and they can now be used at higher working temperatures and for longer periods at the same working temperature.

Tanker News

Hawthorn Leslie (Shipbuilding) Ltd. has announced that the 18,000 dwt S.S.T. tanker "HALIA," built to the order of Shell Tankers Ltd., was launched from Hebburn-on-Tyne Shipyard on August 27. Sponsor of the launching was Mrs. J. P. Berkin, wife of J. P. Berkin, CBE, a manager director of Shell Petroleum Co. Ltd.

Harland and Wolff Ltd. have announced that they have completed the reconstruction of the S.S.T.E. tanker "ESSO GLASLOW" for the Esso Petroleum Co. Ltd. The vessel originally was built in 1944 by the Sun Shipbuilding and Drydock Co., Chester, Pa., USA, as a standard T-2 tanker (her former name being "WAUHATCHIE." She was cut in three sections, and a new middle cargo section was jettied between the original fore and aft sections.

Dr. D. A. Howes

BP Ltd. Forms Chemical Department

In view of the increasing amount of petrochemical manufacture, BP is establishing a new department with responsibility in this field, which will be a separate department from the company's refineries and technical department. The general manager of the new department is D. G. Smith, and Dr. D. A. Howes will be assistant general manager.

Castrol Lubrication Charts

C. C. Wakefield & Co. Ltd. has produced a series of individual lubrication charts, measuring 22 in. x 17 in., for the following range of cars: Hillman Husky, Singer Gazelle, Vauxhall Victor, Volkswagen (1953-57 models). Wolseby 1500; and McCormack International B-250 tractor.

Butane-Propane Floodlighting

The Tilly Lamp Co. Ltd. has developed a new portable propane-butane 10,000 reflected candlepower floodlight, model BT-25, which is adjustable for height and angle, and is completely portable.

Company News

The resolution by certain board members of Premier Consolidated Oilfields Ltd. that L. C. Scruggs should be removed not having passed the board, the board members—with the exception of Mr. Scruggs, R. S. Webb, and Commander John Paul—resigned as of August 1. On August 16, it was announced that William R. Crozier Halpin had been appointed a director and elected chairman. Mr. Halpin is secretary of Lobitos Oilfields Ltd. and Anglo-Ecuadorian Oilfields Ltd.

Personnel

Caltex Transport & Trading Co. Ltd., has appointed A. J. Nettleton, manager of maintenance and repair department O in the place of W. Wilson, who has resigned. Mr. Nettleton, who is a member of the Institute of Marine Engineers, has been superintendent of the company since its inception in 1950.

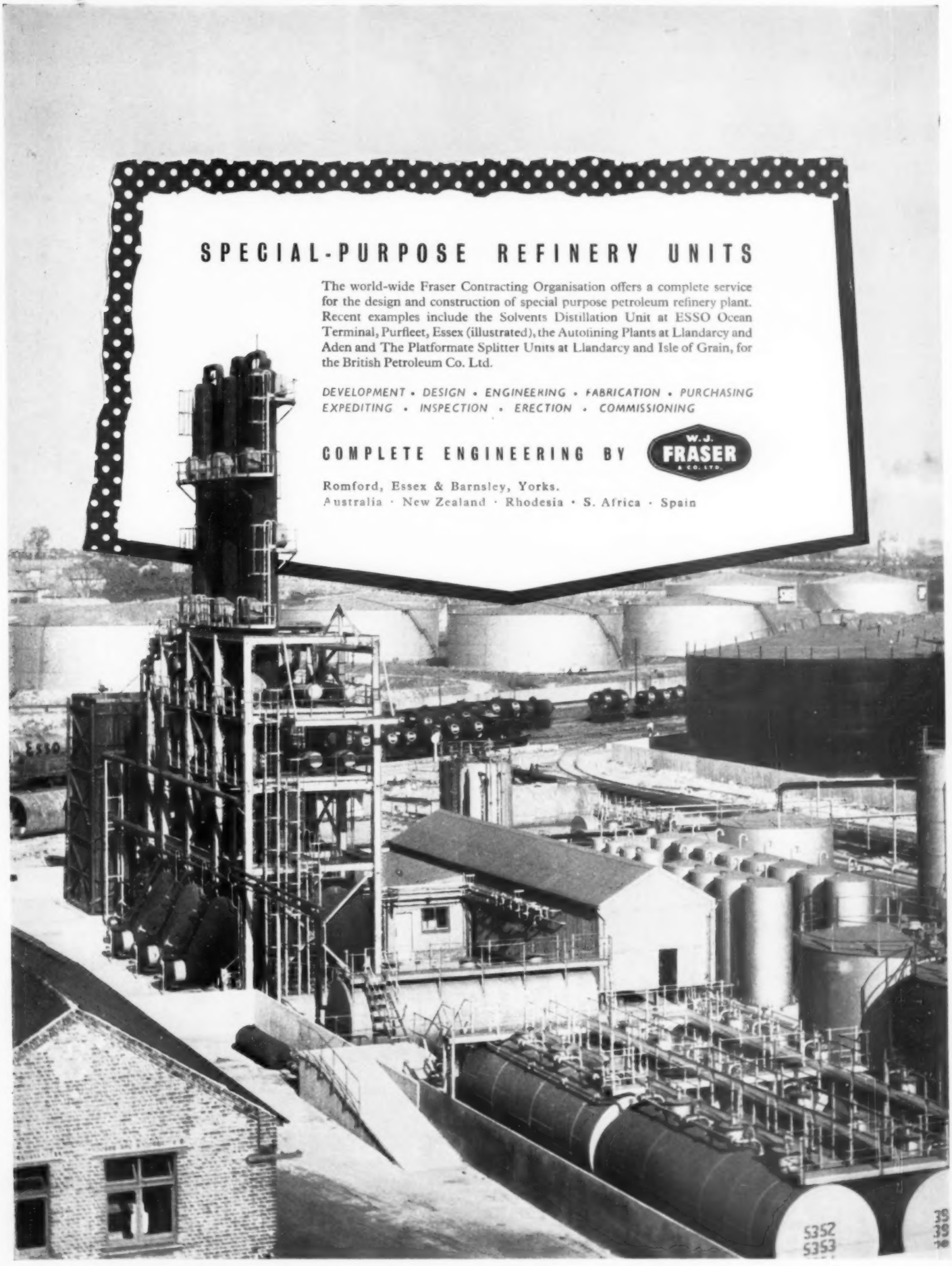
Cape Asbestos & Co. Ltd. have announced that Giles Newton, who joined the company in 1931 and has been deputy chairman and managing director since 1933, has been elected chairman—to succeed Robert Walker, chairman since 1934, who has decided to retire. R. H. Dent and T. C. Hale have been appointed joint managing directors.

T. Muir Warden, of Central Mining Corp., who has been Mr. Walker's alternate since 1954, has been appointed a member of the board.

Kern Oil Co. Ltd. has announced that F. McClain Ziegler, the company's general manager in California, has been appointed a director.

Mobil Oil Co. Ltd. has announced that C. T. Wheatcroft has been appointed the company's industrial representative in Northamptonshire—to succeed Harold Elliott, who is retiring after 32 years' service with the company. Mr. Wheatcroft served his engineering apprenticeship with Ruston & Hornsby Ltd., and is an associate member of the Institution of Mechanical and Production Engineers. He joined Mobil in 1953.

END


SPECIAL-PURPOSE REFINERY UNITS
The world-wide Fraser Contracting Organisation offers a complete service for the design and construction of special purpose petroleum refinery plant. Recent examples include the Solvents Distillation Unit at ESSO Ocean Terminal, Purfleet, Essex (illustrated), the Autofining Plants at Llandarcy and Aden and The Platformate Splitter Units at Llandarcy and Isle of Grain, for the British Petroleum Co. Ltd.
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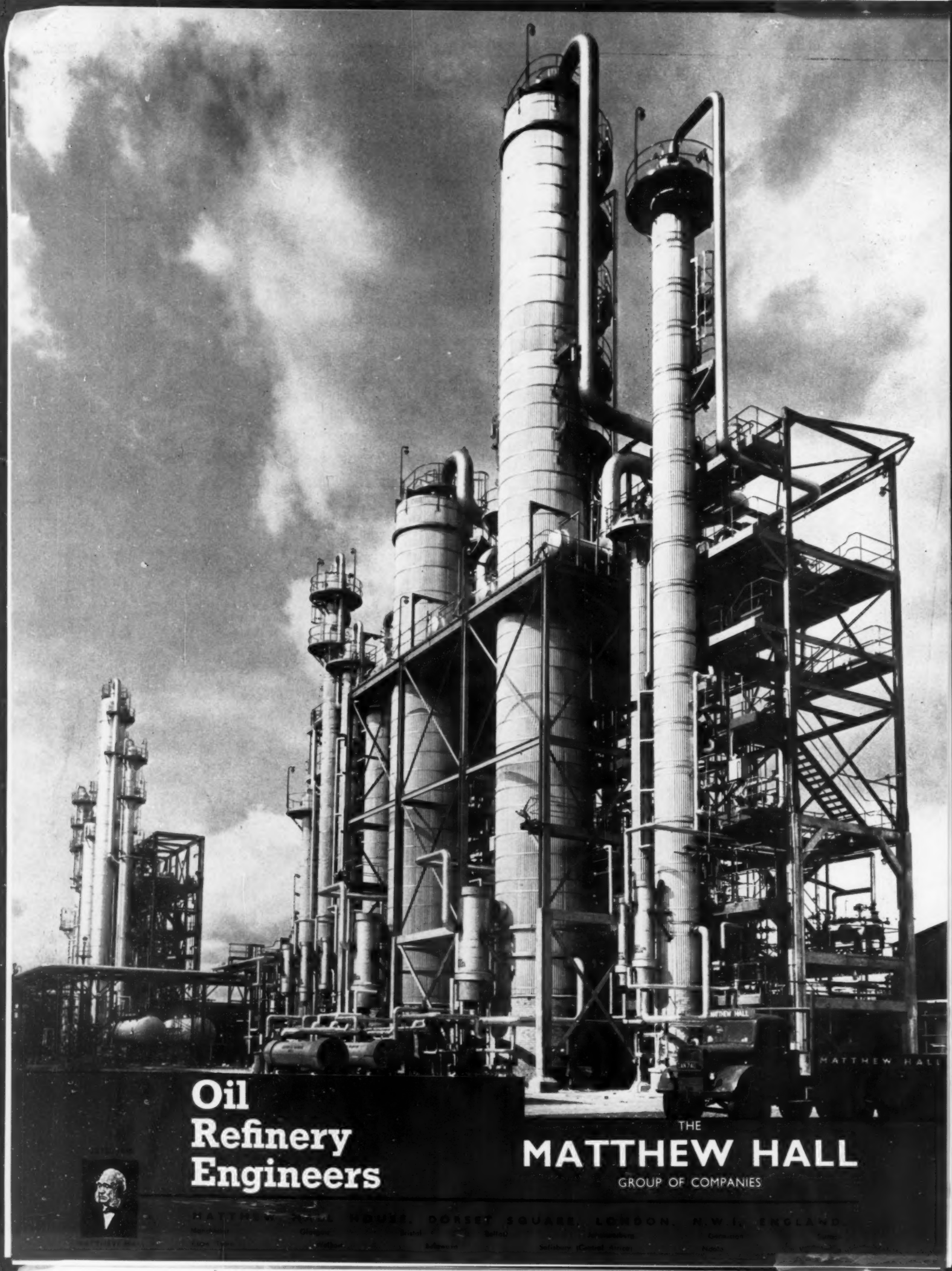

Oil Refinery Engineers

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P57

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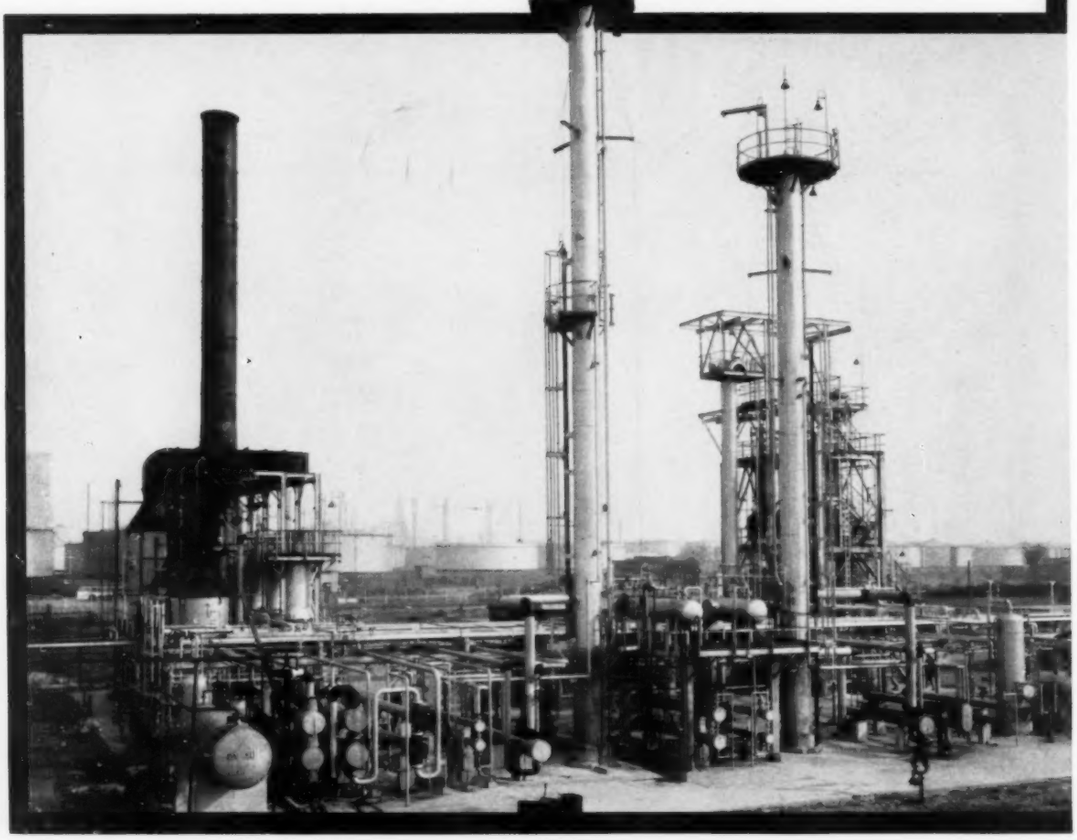

At home or abroad, wherever you need to build, Procon offers the finest construction service. This 800 B/SD Platforming® unit was built by Procon (Great Britain) Limited. The unit was designed to produce an 85 to 90 RON clear product from Kuwait naphtha or a 90 to 95 RON clear blending component from mixed Peruvian naphthas. The Platformer construction included a prefractionator to separate naphtha from full-range gasoline or to prepare a 53-150°C. naphtha for Platforming feed from Peruvian stock.

In England, as in all other parts of the free world, Procon is serving the petroleum, petrochemical and chemical industries with better plant design and construction.

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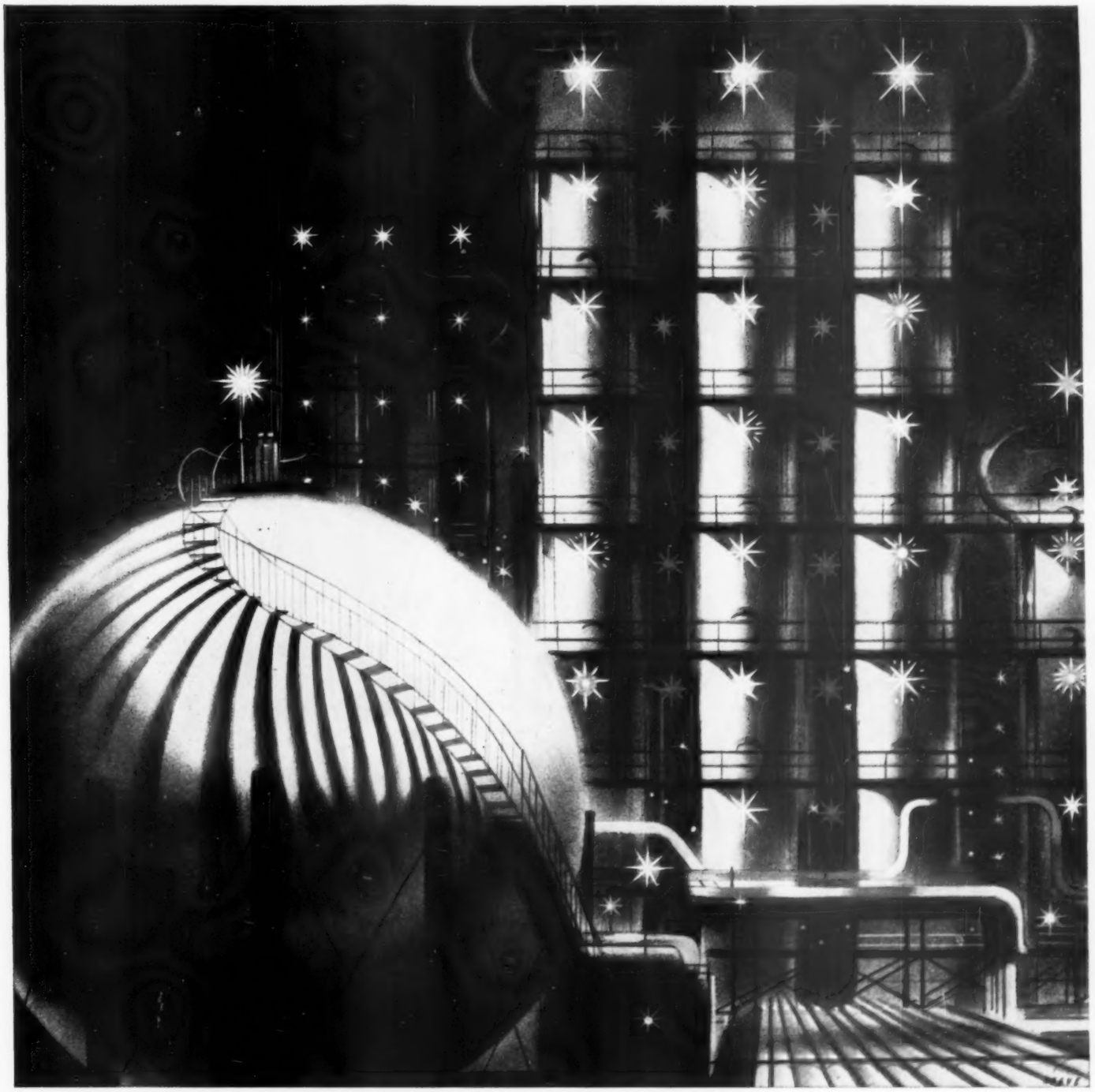

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DU PONT *Petroleum Chemicals* NEWS

Number 81 in a Series of Bulletins for the Petroleum Industry NOVEMBER 1957

New anti-icing additive offers economic advantage to refiners

YOU OUGHT TO KNOW...

JOSEPH G. EVANS is manager of the Petroleum Chemicals Division's San Francisco district, which includes the important northern California refining area near Du Pont's tetraethyl lead plant at Antioch.

Mr. Evans joined the Du Pont Company in December, 1951. He was at first assigned to sales service in the Mid-Continent region with headquarters in Tulsa.

Prior to this he was development engineer for a stoker company in western Pennsylvania, and later organized a company distributing industrial chemicals and specialized lubricants.

Mr. Evans is a graduate of Texas A & M. During the second world war he was an officer in the U.S. Navy, on submarine duty in the Pacific. He was recalled to active duty in 1950 and served two years on a destroyer off Korea. He is a member of the Society of Automotive Engineers, National Sales Executives and the Board of Directors of the San Francisco Sales Executives' Association.

Engine stalls caused by carburetor icing have become more annoying to motorists in recent years. This is because automatic chokes and transmissions on newer cars make it difficult to prevent stalls by "gunning" the engine, especially in heavy traffic. Power brakes and steering, less effective when the engine stops, make stalls a still greater problem.

THIS DEMONSTRATION DEVICE clearly shows the causes and prevention of carburetor icing. It consists of a small ice-cooled air intake and a 1.6-horsepower engine connected to it by a transparent manifold. When unprotected gasoline is drawn through the tube, ice visibly forms and causes the engine to stall. But the addition of DMF to the gasoline maintains constant, ice-free carburetion.

More and more refiners are now using additives in gasoline to prevent carburetor icing. One of the most effective is Du Pont DMF (dimethyl formamide) antistall additive. It is economical; only a little is required for protection. In many instances, less than two milliliters of DMF per gallon of gasoline are needed to keep carburetors ice-free. Therefore DMF is economical to ship, to store and to add to gasoline.

(Continued)

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

CONTINUED *Anti-icing additive*

Marketing advantages

Since motorists are becoming increasingly aware of carburetor icing and the stalling annoyance it causes, you can profitably feature your use of DMF in advertising and promotion campaigns.

To help you capitalize on the motorist benefit of DMF, we have prepared a number of sample ads, poster designs and sales aids (shown above). These dramatize the anti-stalling advantage of gasolines containing DMF. The ideas can be incorporated in your advertising.

Just drop us a line or get in touch with any Petroleum Chemicals Division representative.

In 1956 Du Pont spent $48,000,000 in Texas

During 1956, more than 2,000 Texas firms sold over $30,200,000 worth of goods and services to Du Pont plants in Texas. During the same year, Du Pont payrolls in Texas amounted to more than $17,700,000.

The purchases included raw materials used in chemical manufacturing . . . natural gas, butadiene, propane, ammonia, chlorine, caustic, ethylene, cyclohexane, lubricating oils, and nitric, acetic and sulfuric acids.

Small business concerns supplied many of the more unusual items and services, such as embroidery hoops and cotton gun patches used in analytical work. And a group of Texas oil well drilling experts was retained by the Victoria plant to perforate the steel casing in a 5,000-foot brine disposal well.

Watch the Du Pont "Show of the Month," CBS Network

Importance of credit cards pointed up by findings of new Du Pont survey

What do people really think about oil company credit cards? Finding the answer to that question was one of the objectives of a new study of service station customers' motivations recently completed by National Analysts, Inc., Philadelphia, for the Du Pont Petroleum Chemicals Division.

The survey revealed that 58% of the 2,036 motorists interviewed were favorably disposed toward the credit card principle. Only 16% were opposed, while 26% were undecided. Apparently *this* group is ripe for credit card promotion. An earlier Du Pont survey showed that credit card customers are more loyal to one brand of gasoline than those who do not buy on credit.

Here's why . . .

The new Du Pont survey probed also into the reasons why customers are predisposed toward credit cards. Card holders gave varying reasons for using them: for example, that they were convenient to have on trips and that they enabled motorists to buy gasoline when short of cash. A few card holders retained oil company invoices as records of gasoline and oil purchased.

In spite of the fact that the majority of service station customers' attitudes toward credit cards were favorable, only 18% of all motorists had cards. Of these, 13% had one and 5% had cards from more than one company.

Motivations vary by region

The national survey report has been analyzed to determine regional differences of habit and opinion.

These of course will prove of interest to all oil company marketing men, but especially to those with only regional distribution.

Credit cards are more widely accepted and used in the west coast and southern states.

Such information is but a small part of this new survey. The complete findings have been published in the new book, "Buying Patterns at Service Stations," now being distributed to oil company marketing executives. Requests from others in the industry will be welcomed and filled promptly.

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Cleveland 15—25 Prospect Ave. . . . SUperior 1-1363
Denver 2—Petroleum Club Building, 16th & Broadway . . . . . AComa 2-2347
Houston 2—705 Bank of Commerce Bldg. . . . CApitol 5-1151
Los Angeles 17—612 So. Flower St. MAdison 5-1691
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Pittsburgh 22—1 Gateway Center . . ATlantic 1-2933
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In Canada—Du Pont Company of Canada (1956) Limited, Petroleum Chemicals, 85 Eglinton Ave. East, **Toronto 12**—Ontario . . . . . HUdson 1-6461
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OVER

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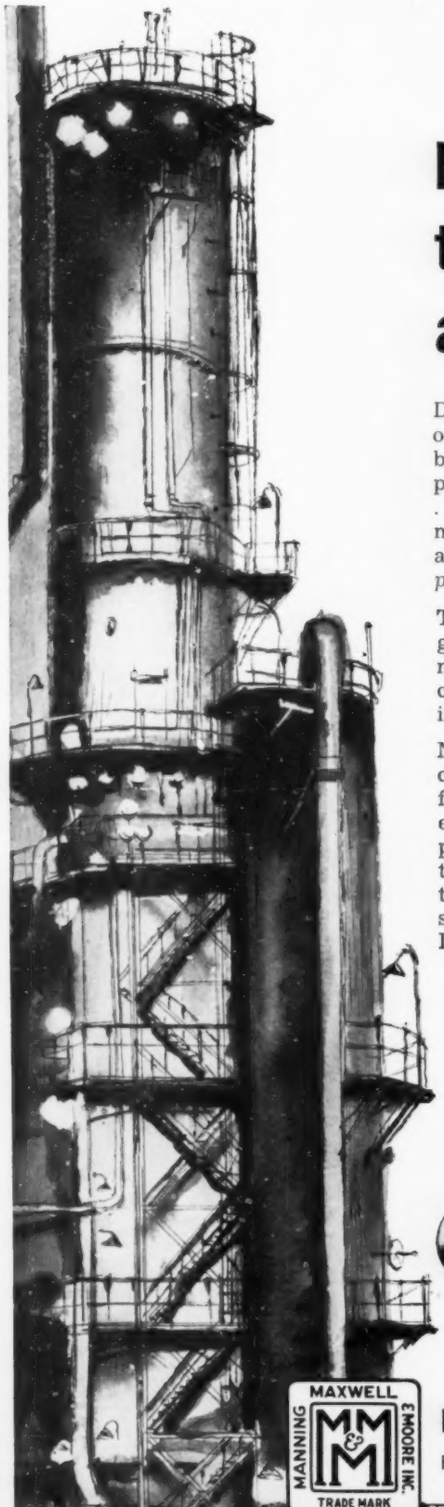

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The year-after-year service record of our gauges, safety and safety relief valves, pneumatic transmitters and steel valves has won increasingly greater preference for these products in the United States, Canada and Latin America.

Now you can specify and readily obtain precisely the same reliability and high performance for your facilities anywhere in the world. The experience, skills and tools of our licensees are producing our brands to standards that satisfy the most exacting requirements. We recommend that you acquaint them with your projects and specific product needs, or write to our Export Division.

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Ashcroft Duragauges
Ashcroft Pneumatic Transmitters
Consolidated Safety Relief Valves
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Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves
Hancock 800# Type 950 Steel Gate Valves

IN FRANCE

SAPAG, Paris
Consolidated Safety Relief Valves
Hancock 1500# and 2500# Steel Valves
Hancock 800# Type 950 Steel Gate Valves
Hancock Steel "Flocontrol" Valves

IN BELGIUM

Ateliers Jaspar, S.A., Liege
Consolidated Safety and Safety Relief Valves

IN WESTERN GERMANY

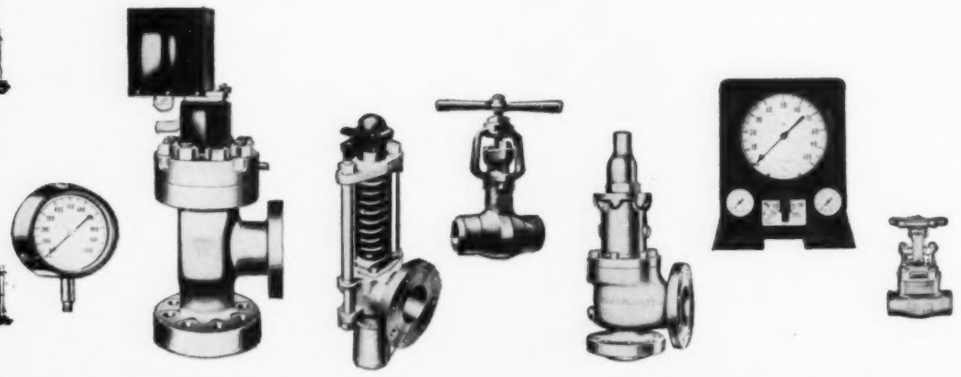
Deutsche Babcock & Wilcox Dampfkessel-Werke, Oberhausen (Rheinl)
Consolidated Safety Relief Valves
Consolidated Safety Valves
Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves

IN ITALY

Societa Carraro & Co., Milan
Consolidated Safety Relief Valves
Hancock Temperature Regulators
Filotecnica Salmoiraghi—SPA, Milan
Ashcroft Duragauges
Ashcroft Pneumatic Transmitters

IN CANADA

Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario
Ashcroft Gauges
Consolidated Safety and Safety Relief Valves
Hancock Bronze and Steel Valves



MANNING MAXWELL & MOORE INC. TRADE MARK

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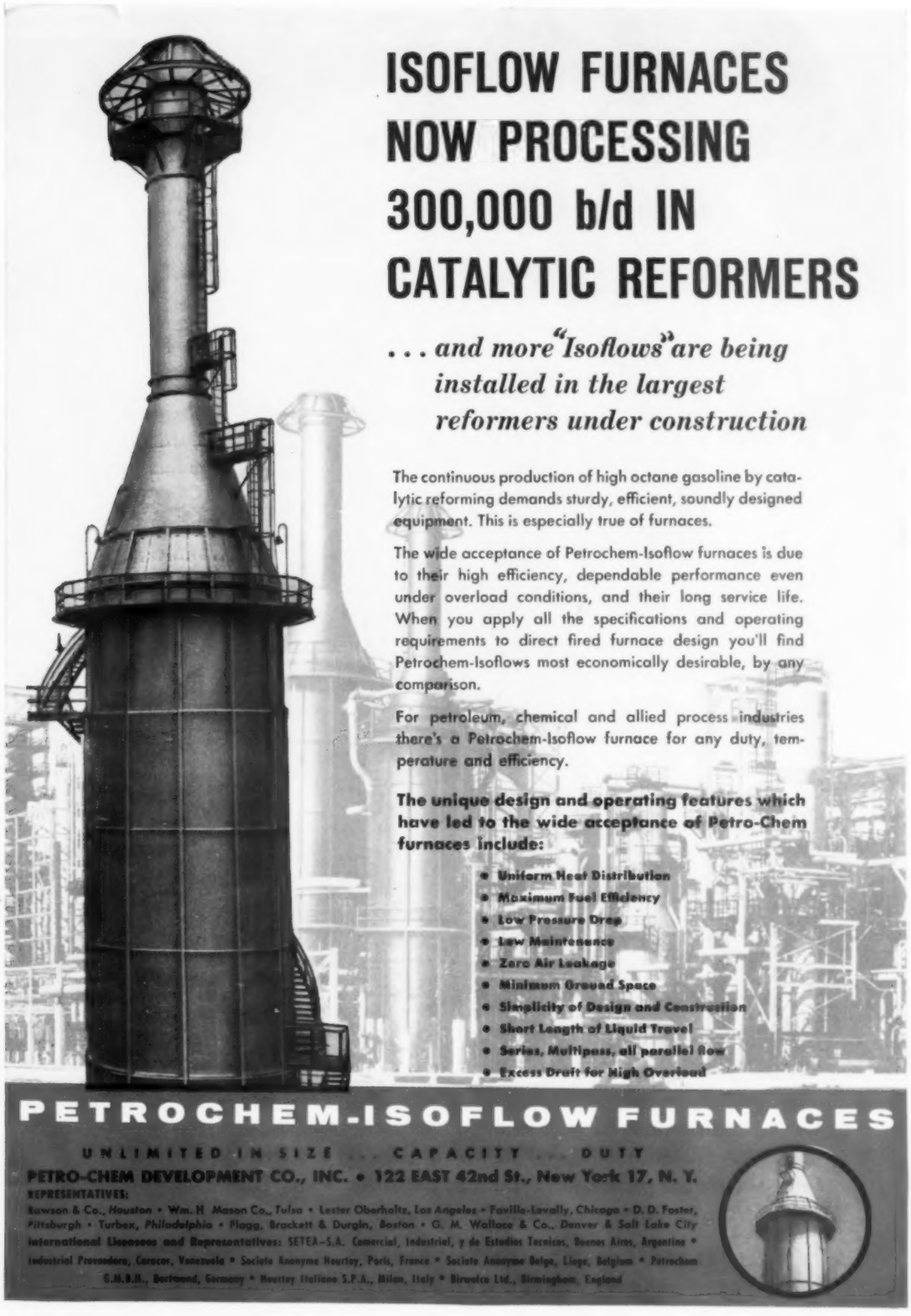
Export Division • Chrysler Building East, New York, New York, U. S. A.



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. . . and more "Isoflows" are being installed in the largest reformers under construction

The continuous production of high octane gasoline by catalytic reforming demands sturdy, efficient, soundly designed equipment. This is especially true of furnaces.

The wide acceptance of Petrochem-Isoflow furnaces is due to their high efficiency, dependable performance even under overload conditions, and their long service life. When you apply all the specifications and operating requirements to direct fired furnace design you'll find Petrochem-Isoflows most economically desirable, by any comparison.

For petroleum, chemical and allied process industries there's a Petrochem-Isoflow furnace for any duty, temperature and efficiency.

The unique design and operating features which have led to the wide acceptance of Petro-Chem furnaces include:

- Uniform Heat Distribution
- Maximum Fuel Efficiency
- Low Pressure Drop
- Low Maintenance
- Zero Air Leakage
- Minimum Ground Space
- Simplicity of Design and Construction
- Short Length of Liquid Travel
- Series, Multipass, all parallel flow
- Excess Draft for High Overload

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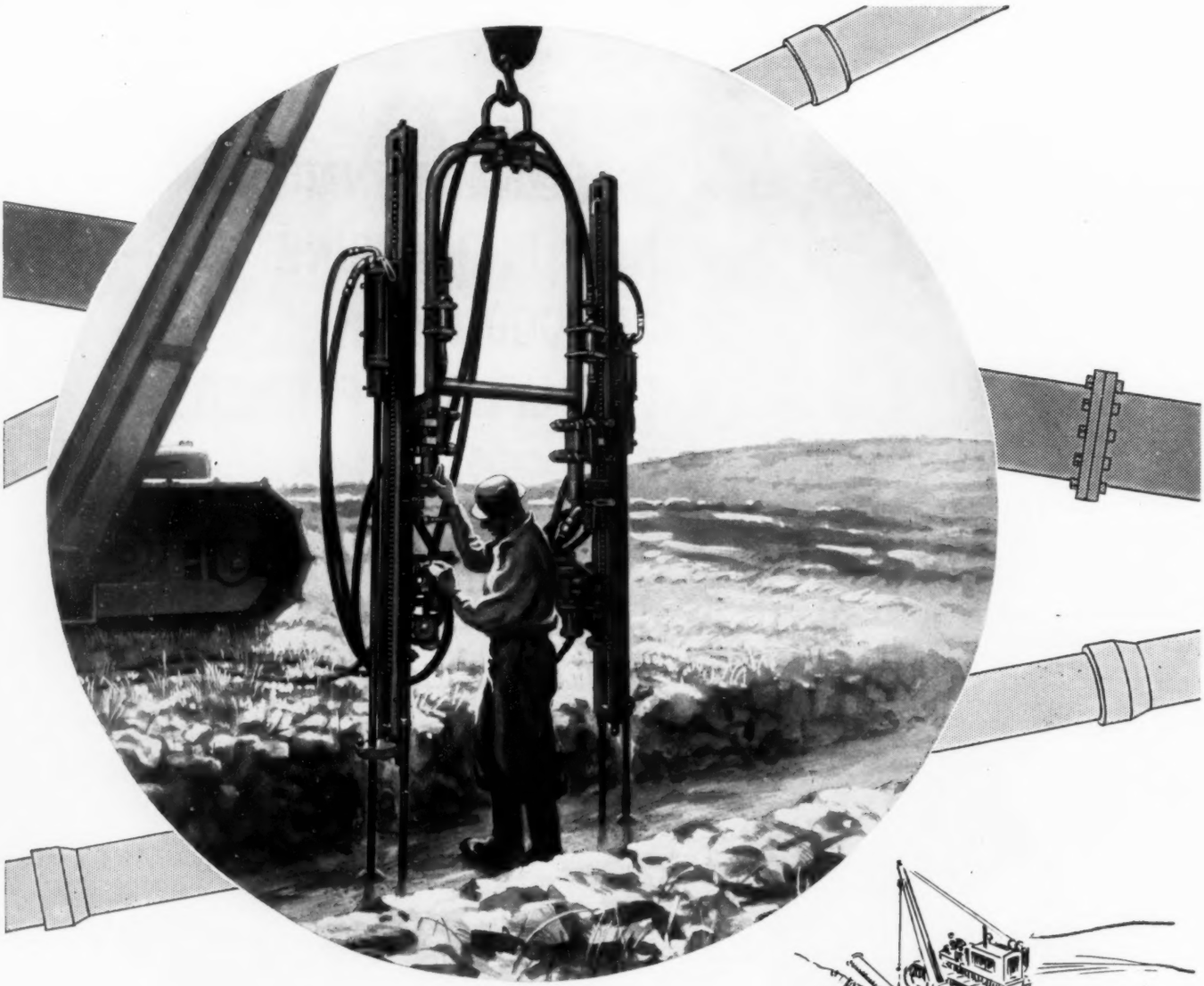
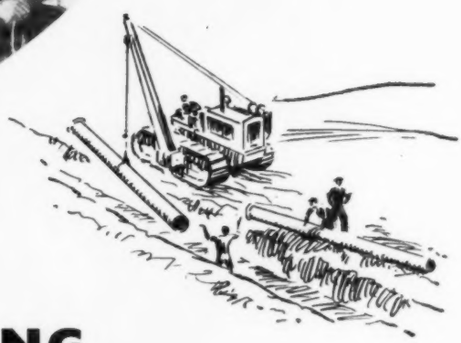




NEW ANGLE ON PIPE-LINE DRILLING

Now *two* men can do the work of *fifteen to twenty* men with hand-held drills!
This tough rig, supported by a tracked vehicle, carries two 4-inch
Climax drifters which fairly *sprint* down the holes—and
think what efficient blasting you get with 4″ holes up to 7 feet deep!
Send now for full particulars of this time and labour saving rig,
British made for delivery anywhere in the world.

THE CLIMAX ROCK DRILL AND ENGINEERING WORKS LTD.
CARN BREA, REDRUTH, CORNWALL, ENGLAND.

CLIMAX TWIN-DRILL TRENCH RIG

TAS/CX.615

Make room for oilmen on the Limited. Our seagoing geologist doesn't usually travel with his coral samples. But they're clues in the search for oil, and he's making the point that oilmen help railroads carry people and freight from here to almost anywhere. The latest count tallied 440 million passengers and 2.5 billion tons of freight in one year. So if your seat mate on the train doesn't know the facts and talks against the oil industry, tell him you're an oilman and proud of it. And tell him why. **SHELL OIL COMPANY**

Oil Company Staff Changes

Thomas P. Simpson

R. Rea Jackson

R. REA JACKSON, general manager of the manufacturing department and chairman of the manufacturing committee of the Socony Mobil Oil Co., Inc., has been appointed chairman of the company's coordination committee. He succeeds Frederic R. Pratt, who has retired after 26 years with the company. Succeeding Mr. Jackson is Thomas P. Simpson, who had been vice president and director of manufacturing of General Petroleum Corp.

R. J. GRAEBNER has been appointed geophysicist for USA and Canadian operations of Geophysical Service Inc. His chief duties will be to provide assistance to GSI seismic field parties and data processing centers. He will also maintain close contact with the research and application sections of GSI's geophysical engineering department. In addition, he will work on long-range planning of new techniques and procedures to be used both in the field and in GSI's data processing offices.

H. H. CHANDLER, superintendent of The Texas Co.'s Eagle Point refinery at Westville, N. J., has been assigned executive duties in London, England, as deputy shareholders' representative. He was succeeded as superintendent at Eagle Point, effective September 1, by V. K. Brandenburg, assistant superintendent of Texaco's Lawrenceville, Ill., refinery.

D. S. GODSHALK, Ponca City, Okla., has been promoted to assistant manager of Continental Oil Co.'s geophysical section, with headquarters in Houston.

STORY J. SLOANE, Jr., associated with the oil business in Houston for 9½ years, has been named land manager of the Commonwealth Oil Co., of Houston. Before joining Commonwealth, Mr. Sloane had been a landman for the Pan American Petroleum Corp., and its predecessor, Stanolind Oil & Gas Co., for 3½ years. Before that he was an independent lease broker in Houston for one year, and an employee of the Shell Oil Co. for five years.

CHARLES W. WEEKS has been appointed district geologist for south, central, and northeastern Alberta, including the Tarsands area of Sun Oil Co. Mr. Weeks' promotion to district geologist will place him in charge of geological work for Sun in Alberta except for the Foothills and extreme northwest corner of the province. He first joined Sun in 1952, when he was employed on a surface party in the Rocky Mountains. He later moved to the Calgary Division Office, where he was assigned duties as a well-site and subsurface geologist, spending a good portion of his time working up the geology of the Alberta Fairway area.

C. ELMER TOWNSEND, former manager of Sun Oil Company's insurance department, died on August 4 at Shore Memorial Hospital, Somers Point, N.J. He was 75. Mr. Townsend, who retired in 1950, spent most of his 31-year career with Sun directing all phases of the company's insurance.

MILO M. BRISCO has been elected executive vice president of International Petroleum Co. Ltd., Coral Gables, Fla. In 1953 he was named general manager of the company's operations in Peru. In 1955 he went to Columbia as International's executive representative in charge of all company operations there. He was elected to the board last May.

James R. Britt

Charles B. Robbins

JAMES R. BRITT, formerly manager of the chemical plants division of Procon Inc., has taken over as general manager of Procon (Great Britain) Ltd., with headquarters in London. Charles B. Robbins, Procon (Great Britain) general manager since 1952, has returned to Procon's home office as assistant to Mr. Whyte.

Procon is a process construction company serving the refining, chemical, and petrochemical industries. In addition to the Great Britain subsidiary, Procon operates in Canada as Procon (Canada) Ltd. and in Latin America as Procon International SA.

D. CARLTON JONES has been appointed assistant manager of production for Hudson's Bay Oil and Gas Co. Ltd. Mr. Jones joined H.B.O.G. in October of 1954, when he was named superintendent of natural-gas utilization, a position he held until his new appointment.

ROBERT O. GARRETT, vice president and general manager of Texas Gas Exploration Corp., Houston, has been elected to the company's board.

Election of James W. O'Keefe as treasurer of the exploration corporation, and appointment of W. J. Wooten as manager of its land department, were announced at the same time. O'Keefe had been comptroller of Texas Gas Exploration Corp., and Wooten was recently employed by the company.

RICHARD C. KERR, consulting engineer to ARAMCO, has accepted the position of consulting engineer to Union Industrielle Africaine (UIA) of Algiers and Paris, and to Transportes Saharions (TRAS) Algiers, and their associated American company, Inter-Equipment, New York. UIA is engaged in the distribution and servicing of oil-drilling and transport equipment. TRAS Algiers is the foremost contractor for off-road oil-field transportation in the Sahara.

H. G. DENHAM has been elected chairman of Mid-East Crude Sales Co. Ltd. He formerly was president. L. H. Nuland, formerly shareholders' representative of Caltex Oil (Australia) Pty. Ltd., in Sydney, has been elected president of Mid-East, and J. A. Triska, who was assistant to the president, has been elected vice president of the company.

MURRAY G. WELLS has been made assistant chief geologist of Cities Service Oil Co., succeeding E. W. Dissler, who has been named resident manager of Canada-Cities Service Petroleum Corp., with headquarters in Calgary, Alberta, Canada.

Mr. Wells, who has been manager of exploration, Mid-Continent Division, for the company, with headquarters in Calgary, Alberta, Canada.

Mr. Wells, who has been manager of exploration, Mid-Continent Division, for the company, with headquarters in Bartlesville, is succeeded by Barron Housel, who has been assistant superintendent of the land department. Mark Payton, division landman for the Mid-Continent Division, becomes assistant superintendent of the land department. Succeeding Mr. Payton as Mid-Continent Division landman is Rex Tarr, who has been assistant division landman at Midland, Texas.

Mr. Wells has been connected with the Geological Division of Cities Service since 1936. He became district geologist in 1941, served as Oklahoma Division geologist in Bartlesville from 1943 to 1951.

Harold D. Hoopman

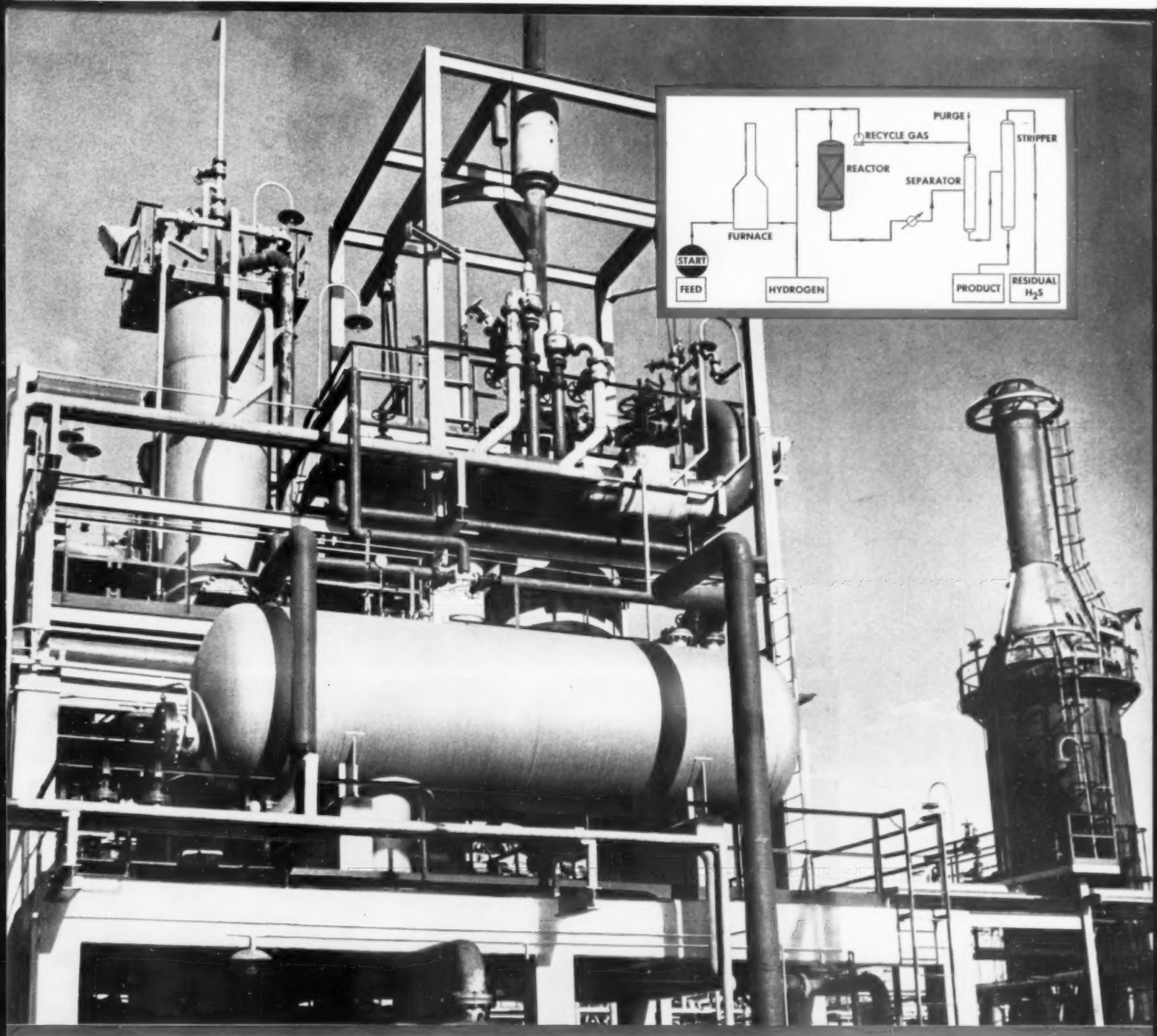
HAROLD D. HOOPMAN is the new operations manager of The Ohio Oil Co. of Guatemala, and will be in charge of all drilling and production on the 1½-million acres of concessions held jointly by Ohio Oil of Guatemala and several other oil companies. J. P. D'Artois is the resident manager, with headquarters in Guatemala City.

E. Clyde Seymour

E. CLYDE SEYMOUR has been named senior vice president of Magnolia Petroleum Co. effective September 1. Starting as a messenger boy in Corsicana, Texas, he is the only active member of the organization who saw service with the company headquarters before they were moved to Dallas in 1914.

Madden T. Works

MADDEN T. WORKS has been appointed manager of operations of turbodrill division of Dresser Industries Inc. He will be in charge of development engineering, manufacturing department, and field service department of the new Dresser division.



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HYDROFINING CAN GIVE YOU TOP PERFORMANCE AT LOWEST INVESTMENT

Esso Research and Engineering Company offers you *Hydrofining*, a process now being applied to a greater variety of feed stocks than any other hydrogen-treating process. *Hydrofining* uses by-product hydrogen to remove sulfur and other impurities *without yield loss.*

The process improves product stability, odor, color and other quality characteristics without the disadvantages of chemical or clay treating methods. *Hydrofining* is another achievement of the Esso Research program — 38 years of new process developments which have been made available to refiners around the world.

Our *Hydrofining* experience with commercial units processing a wide variety of feed stocks such as naphthas, distillate fuels, lubes and waxes — plus years of hydrogenation research — gives us a unique opportunity to recommend the best design for your plant.

Twenty-three *Hydrofining* installations are on stream; eight more are in the construction or planning stage. Licensees enjoy benefits of continuing *Hydrofining* research. *Hydrofining* can play an important part in helping you process previously unattractive stocks into higher quality products. We would welcome your inquiry.

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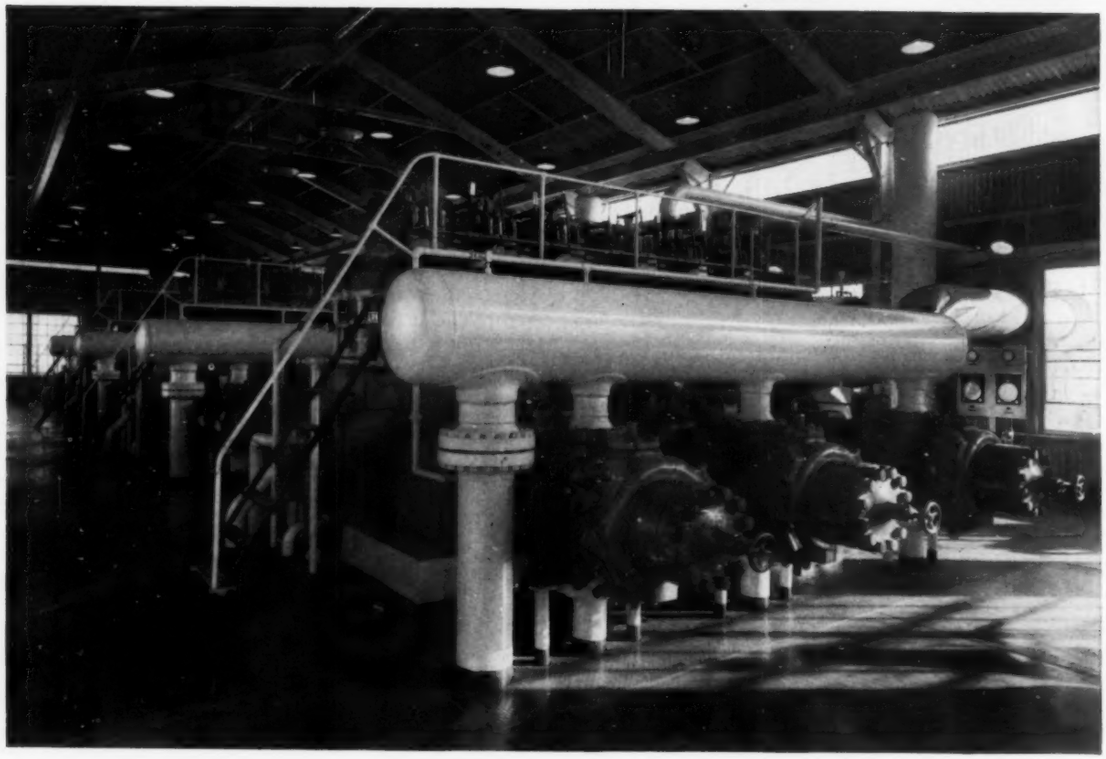

Since Clark introduced the world's first 2-cycle
turbo-supercharged gas-engine-driven compressor in 1953,
over 431,000 bhp. of these modern ultra-efficient units
have been ordered by industry.

POWER

of Clark Turbo-supercharged Compressors now operating or on order

In the Clark tradition, these TLA and TRA units
don't have to be babied or pampered when the going gets rough.
Because they are specifically designed for turbo-supercharging
rather than being beefed-up lightweights, they possess the stamina
to back you up under the most difficult load conditions.
Seven years of experimental and development work *prior* to
their introduction make their outstanding performance possible.

The TLA-TRA have been field-proved by over
1,000,000 compressor hours on stream.

For modern, efficient, trouble-free compressor horsepower at its best,
choose a Clark TLA-TRA. Seven models from 1100-3400 bhp.

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CLARK

Turbo-Supercharged Compressors

Over-the-seas TV is here, *at last!*

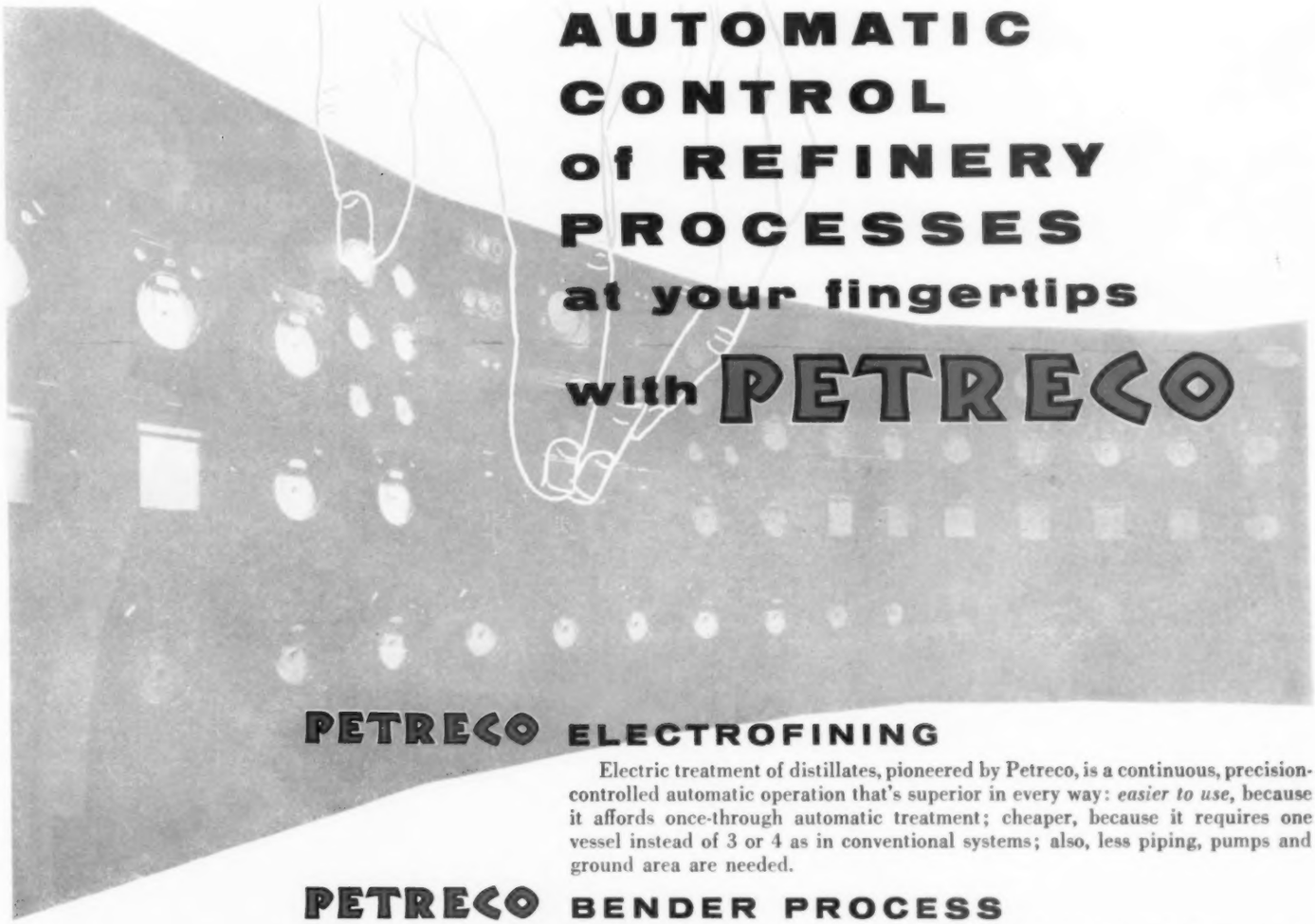
Now there's a new communication link between Miami, Fla., and Havana, Cuba, presaging eventual intercontinental TV. It's the first commercial international installation of a revolutionary new kind of transmission – *broadband* over-the-horizon microwave. It's the first reliable system that can beam TV over the horizon instead of by line of sight! Intercontinental TV is on its way for all the Americas...

Equipment for this new system was developed by engineers of Federal Telecommunication Laboratories, U. S. research division of International Telephone and Telegraph Corporation. The *broadband* method greatly increases the signal-carrying capacity of over-the-horizon microwave equipment. For example, the Miami-Havana link is able to handle 120 telephone channels, *plus television*, with a transmitted power of 10,000 watts.

OTHER "FIRSTS"—Long a pioneer in microwave communication—in fact, the first to demonstrate the technique—ISE and its associated companies in the IT&T family have also designed and installed other commercial over-the-horizon microwave systems now or soon to be in operation. One is a 240-mile system between Minorca and Sardinia, which connects the two widely separated communication systems of Spain and Italy. In addition ISE is engineering and will install the Command Communication Network for NATO—microwave links extending from northern Norway to eastern Turkey.

ISE
AN ASSOCIATE OF
IT&T

INTERNATIONAL STANDARD ELECTRIC CORPORATION, *Export Department:* **50 Church Street, New York 7, N. Y., U. S. A.**



AUTOMATIC CONTROL of REFINERY PROCESSES at your fingertips with PETRECO

PETRECO ELECTROFINING

Electric treatment of distillates, pioneered by Petreco, is a continuous, precision-controlled automatic operation that's superior in every way: *easier to use*, because it affords once-through automatic treatment; cheaper, because it requires one vessel instead of 3 or 4 as in conventional systems; also, less piping, pumps and ground area are needed.

PETRECO BENDER PROCESS

Sweetens gasoline, kerosine, jet fuel and No. 2 fuel by catalytically converting the mercaptans to disulfides. The chemical cost is low and throughput rates are consistently high. The catalyst requires only occasional regeneration, and this can be conveniently done right at the plant site.

PETRECO ELECTRIC DESALTING

The electrically-shielded multiplane field, developed by Petreco engineers, removes salts, solids, and other impurities in the 98-100% range. This process is the result of 46 years of continuous development. Refiners throughout the world consider the Petreco all-electric desalters an integral part to crude oil processing.

PETRECO LUBE OIL TREATING

A continuous, automatically-controlled treating method. Replaces conventional batch agitator method of acid treating lube oil stocks. The use of an electric field causes rapid coagulation and settling of the sludge, so that mixing of acid and raw lube stock can be more intense. This results in chemical savings in both the acid and neutralization stages.

WANT MORE INFORMATION? *Write for additional literature, stating your* ***particular*** *interest or problem.*

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Specialized Electric Petroleum Treating

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Modern methods for ancient acres

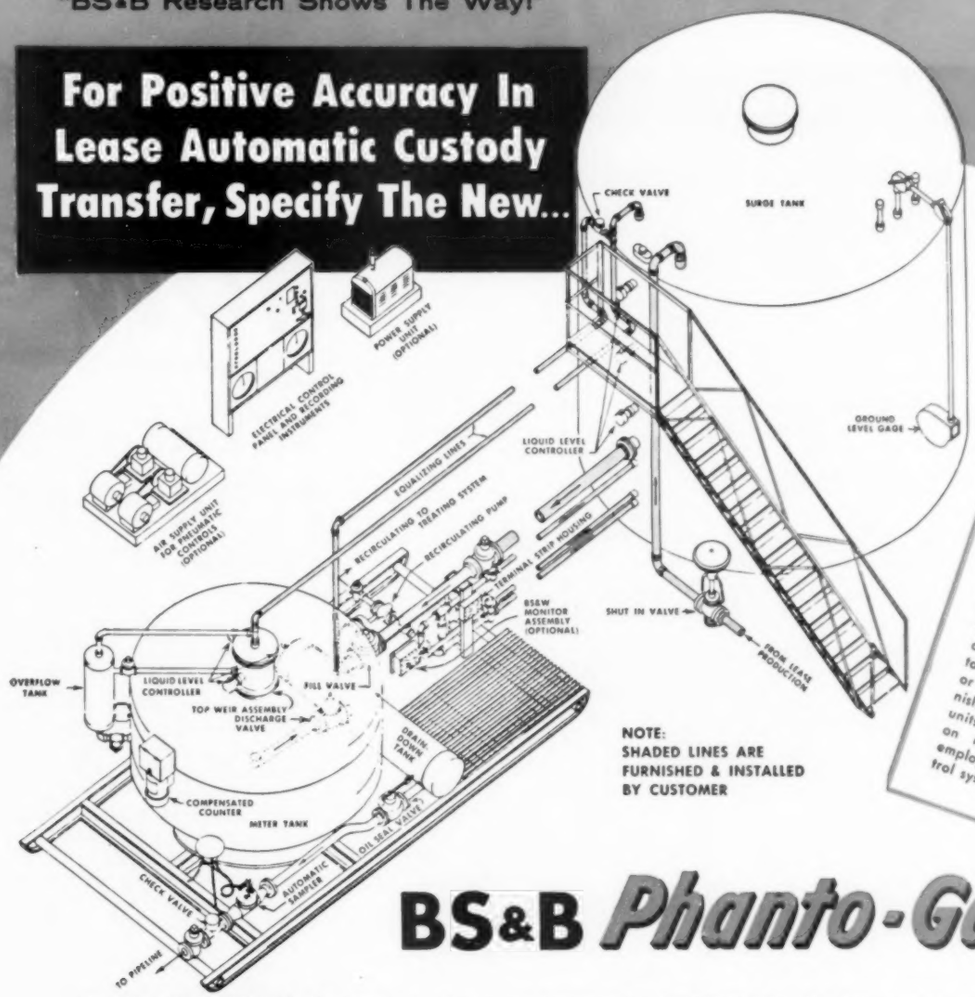
Over centuries-old fields of rice and sugar cane a new sound is being heard ☆ Shouts of encouragement to plodding carabaos and oxen are being supplanted by the hum of modern farm machinery ☆ Efficient equipment is bringing in bigger crops with less effort—aiding economies, easing the farmer's life ☆ In many of the countries where agriculture plays a vital role, Caltex quality petroleum products help maintain and expand farm prosperity ☆ Through the power of petroleum, Caltex fuels and lubricants run the machinery that lightens the work load, increases the standard of living for the peoples of over 70 countries. Caltex—partner in progress in Europe, Africa, Asia, Australia and New Zealand.

CALTEX

PETROLEUM PRODUCTS

"BS&B Research Shows The Way!"

For Positive Accuracy In Lease Automatic Custody Transfer, Specify The New...



NOTE:
SHADED LINES ARE FURNISHED & INSTALLED BY CUSTOMER

PHANTO-GAGER VOLUMETRIC METER TANKS . . . are available as standard in 25 and 50 bbl. sizes, but larger tanks capable of handling production of up to 1,000,000 bbls./day or over can be furnished. Smaller sized units are also available on request. All units employ standard control systems throughout.

BS&B *Phanto-Gager!*

The BS&B PHANTO-GAGER is that part of BS&B's new PHANTO-MATIC Lease System which automatically performs all the functions normally required to accomplish Lease Automatic Custody Transfer. It will:

1. Automatically measure and record temperature compensated oil volume in bbls.
2. Automatically measure (or automatically sample and subsequently determine) oil quality and contaminants.
3. Automatically run crude oil from a lease into connecting pipeline in accordance with predetermined schedules (if required) on an unattended basis.

The Extreme Accuracy of the PHANTO-GAGER is such that the purchaser or his agent is assured of receiving the *exact* amount of gross oil indicated by each recorded run because:

1. The upper weir on the meter tank and the degassing time when the oil is above the weir on filling are designed to give a positive high level gage.
2. The use of a valve between the meter and the drain down tank, plus a set drain down time, gives a positive low level gage.
3. The accuracy of measurement is not affected by the speed of valve action.
4. The meter tank and lines included in the calibrated volume are free of gas traps while filling, liquid traps while emptying.

Fail Safe Controls on The PHANTO-GAGER insure that no oil will be lost in case of power failure because:

1. The fill and empty valves on the meter tank are electrically interlocked.
2. Oil cannot be introduced into the meter tank after the measuring cycle has started, nor can oil be removed from the meter tank (other than to the pipeline) after the top gage has been made and before the run is completed.
3. All electrical controls, motors, instruments and wiring within 150 ft. of the meter and surge tanks are explosion proof.

Together, the BS&B PHANTO-GAGER and the BS&B PHANTO-PUMPER (which automatically performs all lease operations ahead of the PHANTO-GAGER) make up the complete BS&B PHANTO-MATIC Lease System. This gives the lease operator full automation from the wellhead to the pipeline. Ask your BS&B Man to give you full details, or write to . . .

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IN CRITICAL PROCESSING OPERATIONS WHICH REQUIRE:

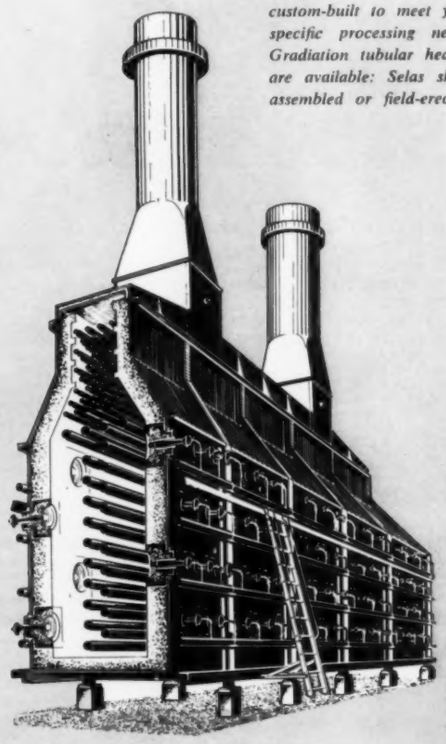
- Preciseness in heating
- Ability to handle a variety of feed stocks, *ethane and butane in one heater, for example*
- Instant response to controller demand *achieving closer equilibrium approach*
- Zone Control—*up to 3 independent coils in the same heater*

SELAS GRADIATION® HEATERS are specified.

These heaters have proven highly beneficial in numerous critical applications, including:

- Visbreaking
- Light Hydrocarbon Pyrolysis
- Catalytic Reforming
- High Temperature Heating *including cylindrical vertical reactors.*

Specially-engineered and custom-built to meet your specific processing needs, Gradiation tubular heaters are available: Selas shop-assembled or field-erected.



NOW

SELAS ANNOUNCES ECONOTHERM*

a new family of TUBULAR HEATERS

For many good reasons, chief of which is the demand for heaters to accomplish non-critical processing, Selas Corporation of America has created a new family of tubular heaters to be known as Selas Econotherm Tubular Heaters.

Econotherm Heaters are being used where operations require materials to be heated to below decomposition temperatures; where, because of this condition, precise control is not essential; where—because of the nature of the operation—low cost is an important factor.

Actually, Econotherm Heaters are not new to Selas or to its customers. Previously furnished as custom-built units to meet specific non-critical requirements, basic Econotherm designs have now been developed to achieve maximum economy. Three representative configurations, together with their processing capacities, are shown on the facing page.

And, to meet processing conditions not covered by these standard units, specially-designed Econotherm Heaters will continue to be custom-built as required.

Unlike Selas Gradiation Heaters which use Duradiant® burners to accomplish their preciseness of heating in critical processing, Econotherm Heaters employ flame-type burners and can accommodate gas, oil or combination firing.

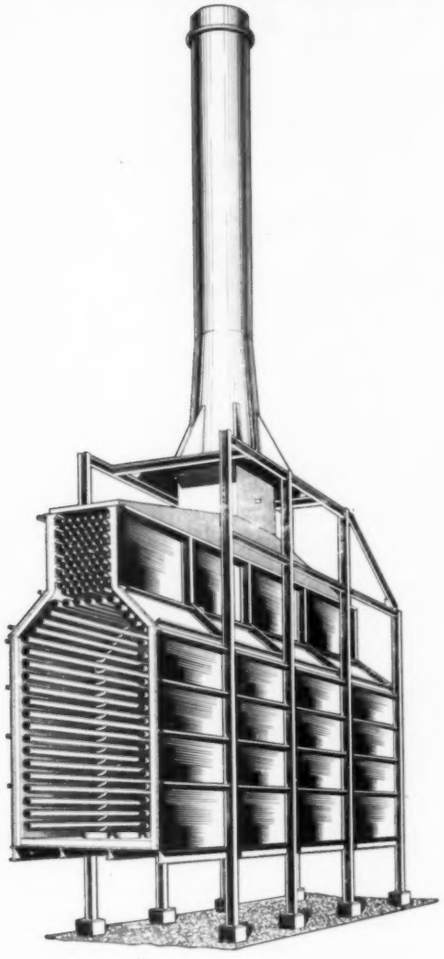
The addition of this new family to Selas' Fluid Processing Division serving the petroleum, petrochemical and chemical industries, rounds out the line of heaters so that processors may call upon Selas for every heat-processing need.

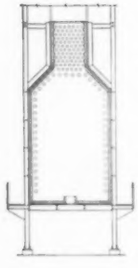
Write Dept. 1611 for bulletin "Gradiation Heating for Petroleum and Chemical Processing" and for more detailed information about Selas Econotherm Heaters.

*Trade Name

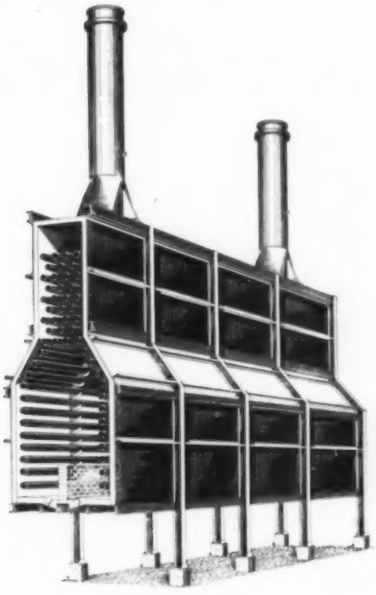
SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

PETROCHEMICAL and CHEMICAL INDUSTRIES

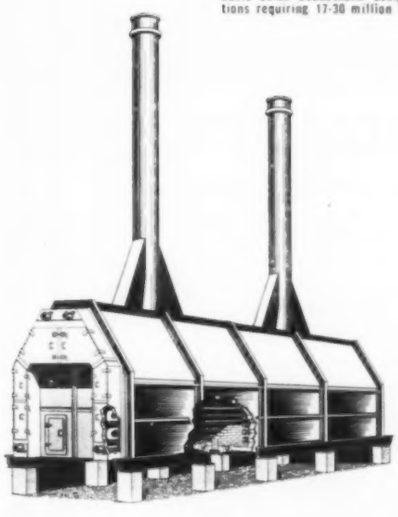




Basic Selas Econotherm design for processes requiring more than 30 million Btu per hour.



Basic Selas Econotherm design for operations requiring 17-30 million Btu per hour.



Basic Selas Econotherm design for processing requirements from 8-17 million Btu per hour. A basic design is also available for requirements up to 8 million Btu.

Heat and Fluid Processing Engineers

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SELAS

McCullough
double-acting
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CHECK THESE FEATURES

- Will strike a feather touch or up to 100-ton metal-to-metal blows.
- Force of blow controlled by operator at surface.
- Jars up or down at will of operator.
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- Consistently used with all makes of testers.
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- Most widely used Jar in foreign operations.
- Very little maintenance required.
- Packed for high pressure.
- As shown at right, has only four parts (2 major jarring elements)—no slip dogs nor hydraulic mechanisms to fail; no threaded joints to unscrew.

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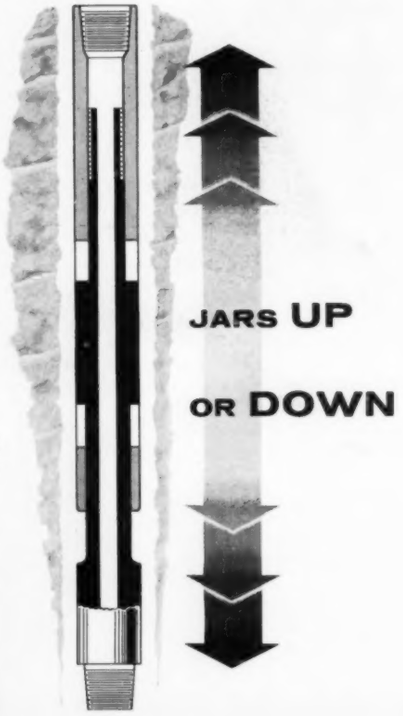
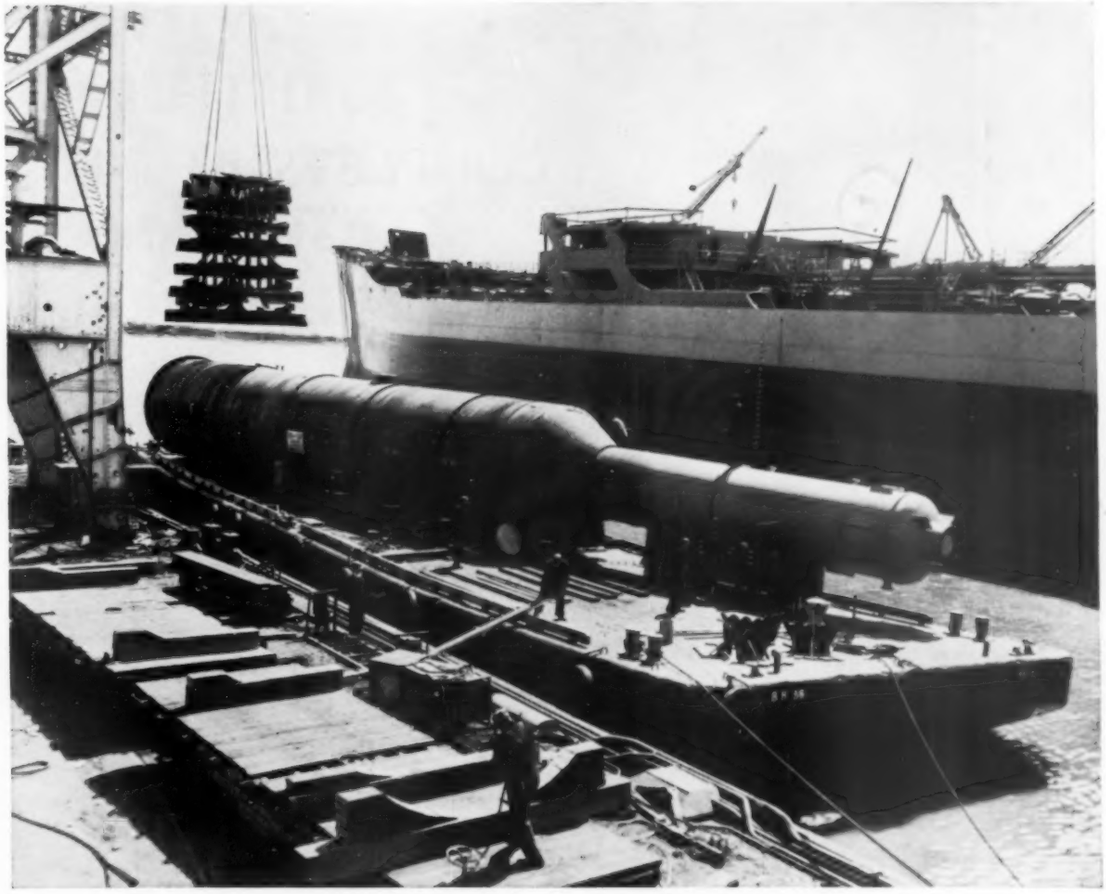
Improvement in McCullough Jars adds 97% to jarring surface areas—gives greater strength and increases service life.



CONTROLLED POWER
for every jarring operation



standard procedure: VERSATILITY . . .

The variety of work which Sun Ship's integrated shops produce for use by industries on land and sea brings a matching variety of shipping problems.

Our facilities for tidewater shipment are used to economical advantage on many of the massive structures that go into the making of the nation's petroleum and chemical industries. The barge shipment of tower and shed row baffles, shown above, is a good example.

And of course—when shipment by land is necessary—Sun Ship rigging and routing find the ways and means to handle such items as large-diameter columns by rail and truck.

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Our Sales Engineering Department would be glad to use its experience in helping you overcome any problem of construction or shipment that faces you. Write

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ON THE DELAWARE (SINCE 1916) CHESTER, PA.

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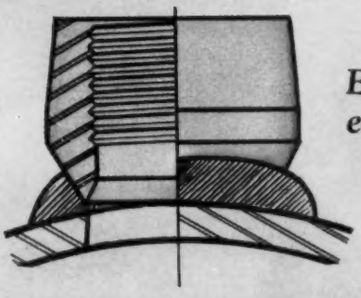

Economical and easy-to-install

Readily modified for small diameter installation

W-S Couplets are designed to function as universal outlet connections for tanks, process vessels and pipelines. They eliminate the need for large expensive field inventories and costly delays in fabrication. On most tank, and large piping installations they are used as received. On those few applications where attachment is to be made to a small diameter pipe, the W-S Couplet is easily modified by contouring the welding end with an acetylene torch to mate with the curvature of the pipe. Couplets are made with extra length and heavy wall to permit contouring without detriment to the threaded or socket end.

W-S Couplets are available in sizes ¼" through 2", with screw-end or socket-welding dimensions . . . also in a 90° elbow.

Send for Bulletin CP-1-57. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.

W-S FITTINGS DIVISION

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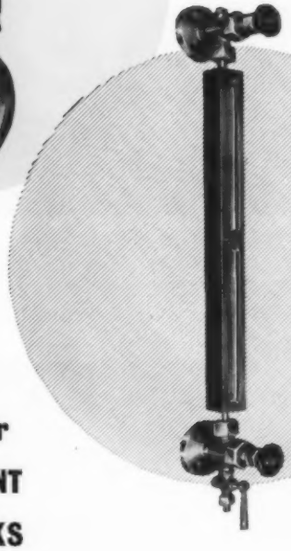

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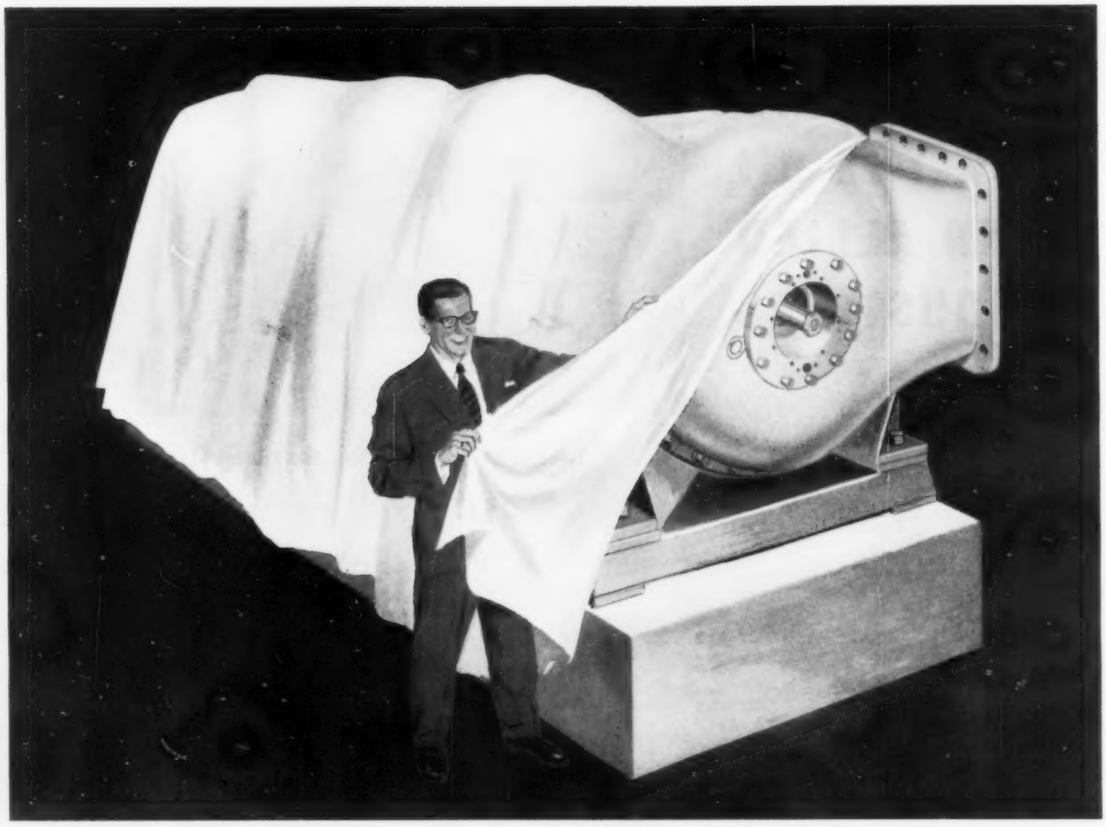

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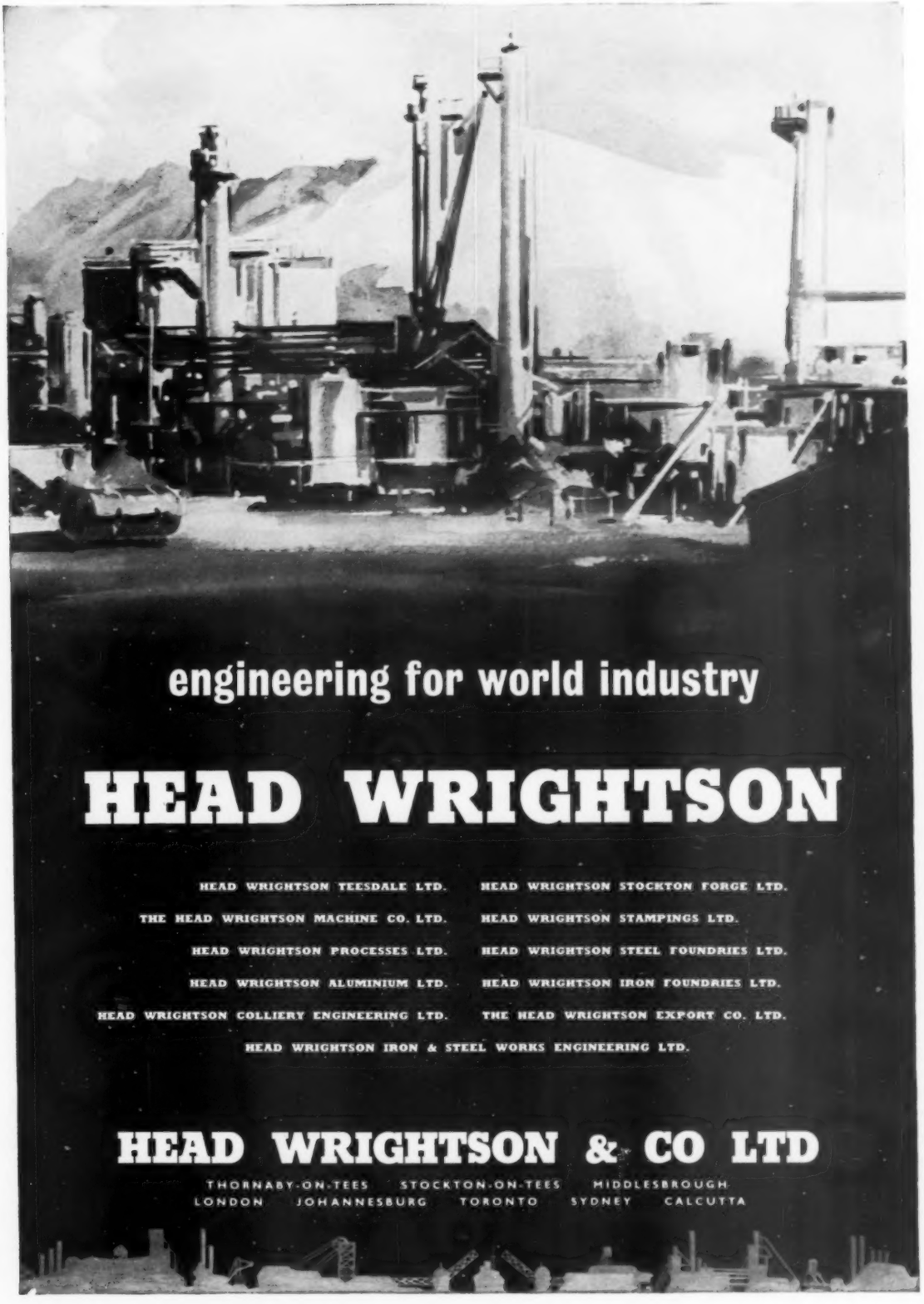
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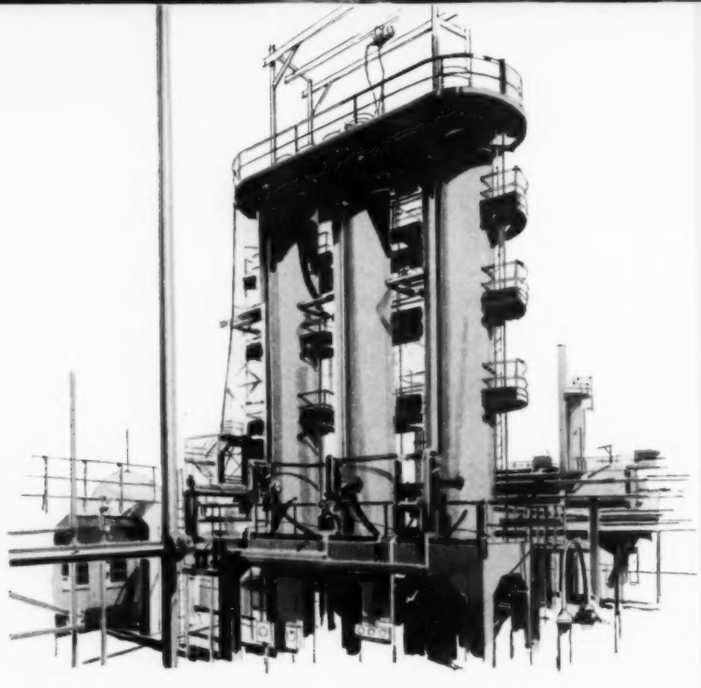

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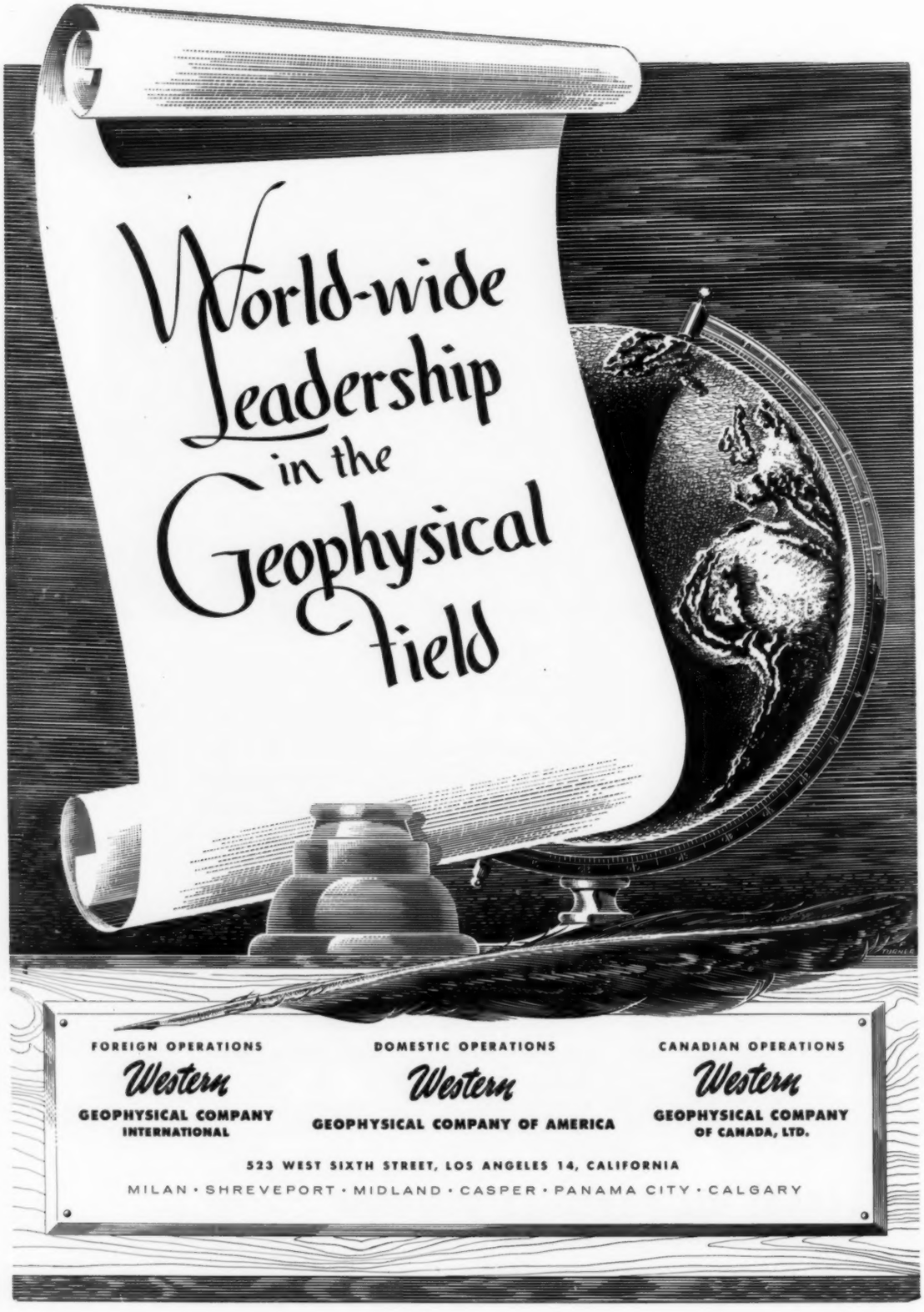
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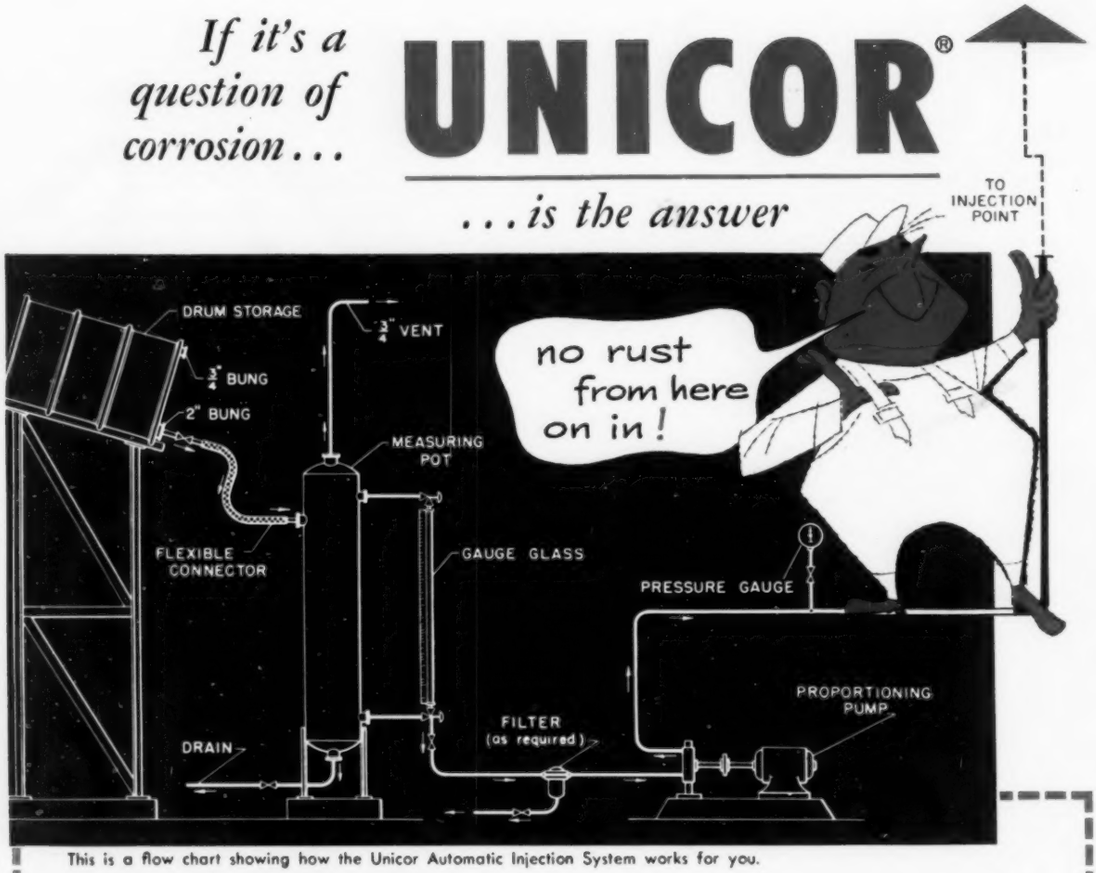

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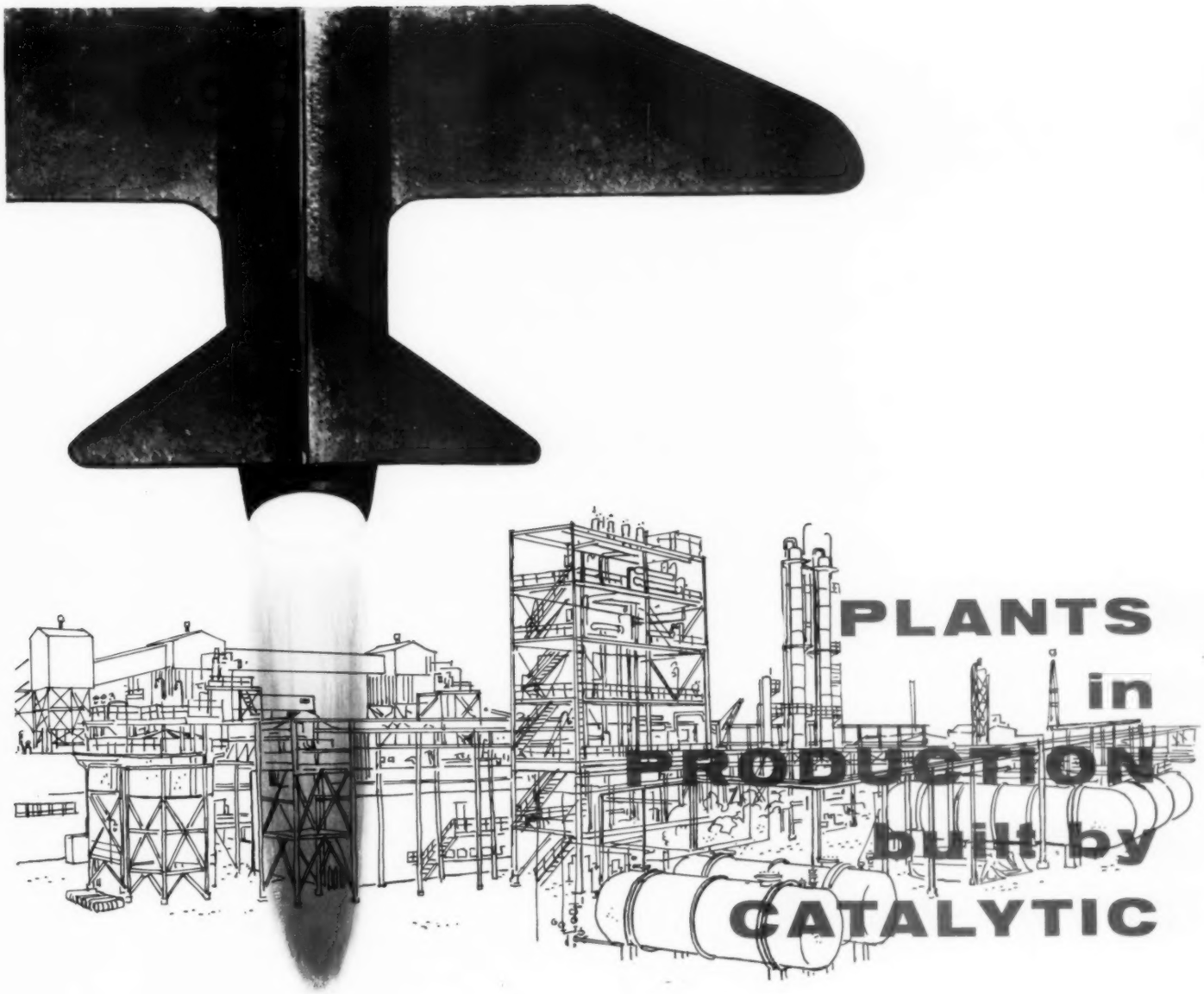

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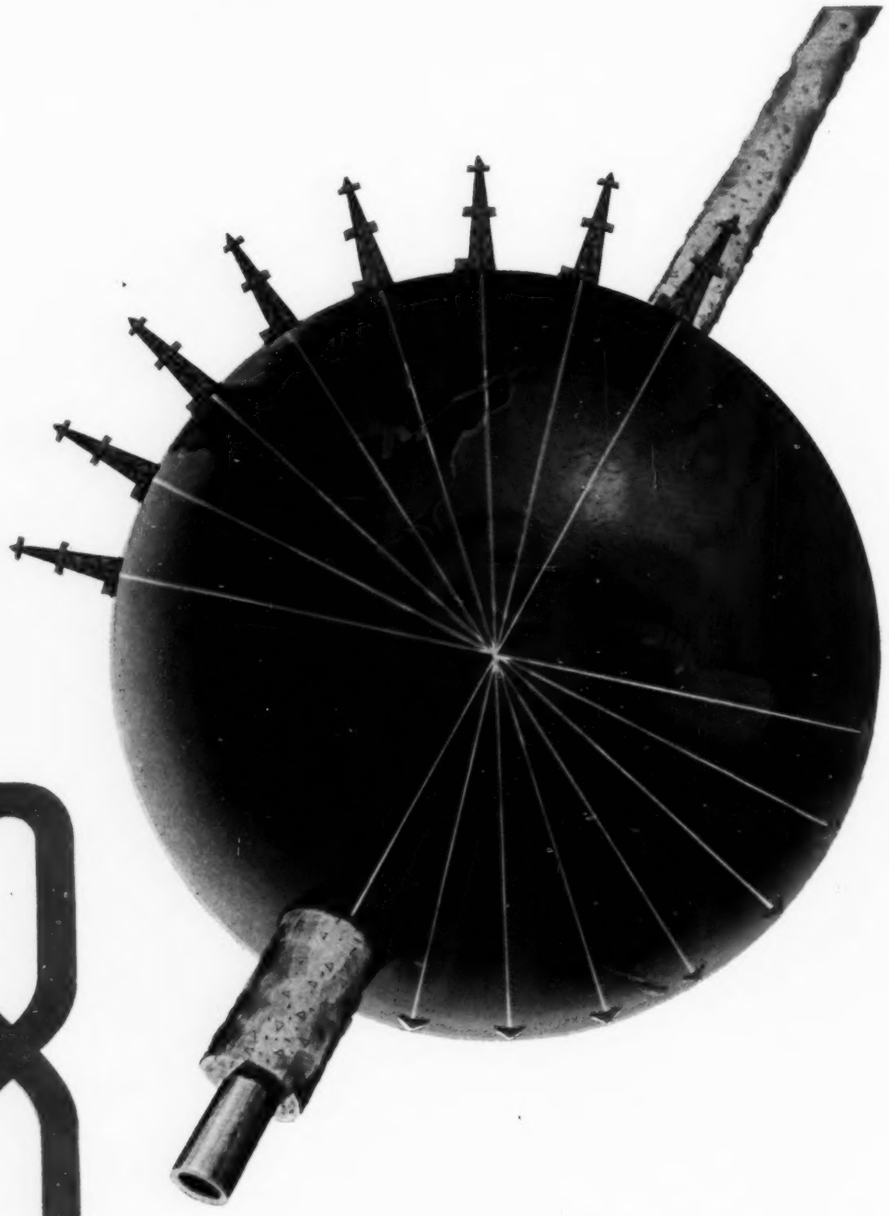

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"CONTINUOUS AID TO MODERN PETROLEUM TECHNOLOGY"

Need for unity

By Jake L. Hamon

(Chairman, American Petroleum Institute)

This coming meeting of the American Petroleum Institute will end my term of office as chairman of its board of directors.

My successor will be faced with a discouraging outlook in 1958. I am not referring to the unsatisfactory statistical situation of our industry, because in a highly competitive, aggressive group such as we are, we usually overproduce, overrefine, and depend on some unusual unforseen circumstance to save us from utter chaos. This has been true of the oil business since its inception, and will continue to be that way in the future. We are oblivious to the meaning of statistics, and equally determined to proceed each on our merry way regardless of any economic storm signals.

However, it is the failure of the individual members in different segments of the industry to realize the need for unity that makes the outlook for next year a depressing one. This lack of unity hurt us badly during the past year, what with the controversy and criticism that swelled up over the crude price increase, the European oil lift, the MEEC (O'Mahoney) hearings and reports, the difficulties faced by the Harris bill in the Congress, and the Virginia grand-jury investigation. To my successor in office, I can offer little hope that 1958 is going to be any better or any brighter. We can rest assured right now that, from a public-relations viewpoint, the petroleum industry is going to have a variety of unjustified black eyes hung on it before the year is out.

Oil, unfortunately, is going to have to carry on two vital operations simultaneously in Washington in 1958: the fight for the Harris-O'Hara gas bill, and a defense of percentage depletion. It is reasonable to assume, too, that at least a half dozen or more satellite affairs, each a fairly important one in its own right, are going to be trotted forth in the congressional arena. These latter include such carryover items as imports, divorcement, anti-trust, S-11, South America government help, and so on. There are rumors that investigations may be launched into pipelines, tankers, and even state regulatory agencies.

The fact that 1958 is an election year isn't going to help matters either. Critics of the industry are going to use every opening possible to further their own ambitions, and try to enhance their chances for re-election. Thus they will seize every opportunity they can to carp and criticize.

The outlook for the Harris-O'Hara bill, which will give needed relief to independent gas producers, and snuff out a potential threat to ultimate federal control of oil production is neither good nor bad. This measure, like any controversial one, which has to negotiate both houses of Congress in the same legislative session, during an election year, is in for a difficult time. Even with President Eisenhower's definite endorsement and support, the bill won't pass without strong industry support. It needs more than the present lukewarm attitude if it is to succeed. The bill is the best bill we can get; and the longer relief is delayed, the more complex become the problems of the gas producers, and the more troublesome it is going to be to get any kind of a bill through Congress. Realizing this fact, the industry should make an all-out effort to rally support for the Harris-O'Hara bill.

It is somewhat difficult at the moment to make an accurate forecast of percentage depletion possibilities. It is being taken up in the course of a House Ways and Means Committee review of federal tax policies. Trade publications and Washington correspondents have warned that opponents of percentage depletion have been mustering their strength right along, and are planning to make an all-out assault on it. The depletion provision is essential for all extractive industries, and the necessity for it can be clearly and logically proved. Logic frequently loses out when it is opposed by prejudiced emotions, as is the case here. We are a great industry with a great record of achievement, but next year our disunity threatens our very existence. The failure of the various segments of our industry to realize the crippling effect of such disunity makes the future look dark. I hope that my successor can get the industry to unite and rise to the occasion, as it has so often done in the past. END

THE IMPORTS QUESTION . . .

This page begins a symposium of viewpoints regarding the controversial oil imports question. It is written by our country's leaders on each side of the controversy (Editor).

as seen by the US Government

Fred A. Seaton

By Honorable Fred A. Seaton
Secretary of the Interior

THE reduction of oil imports into the United States is one of today's most pressing national problems, and our current program to reduce oil imports by voluntary agreement is necessary to our national security.

World War II and the recent Suez crisis both demonstrated the crucial importance of a vigorous domestic petroleum industry. Oil powers our ships and planes, moves the wheels of our industrial machines, and underwrites much of the electrical energy needed by our expanding population. Today, oil and gas supply two-thirds of all energy consumed in the United States, and are an indispensable part of the economic lifeblood of America.

In the best interests of its people and world peace, the United States cannot, therefore, allow the health of its domestic petroleum industry to be undermined by constantly increasing imports of oil. Neither can we assume the costly liabilities of a domestic oil industry which becomes too heavily dependent upon sources of petroleum outside our shores.

There is compelling evidence that the continually rising proportion of oil imports to domestic production threatens to create these conditions. This is the basis of the concern of the United States Government, and the situation we seek to correct through our voluntary program to restrict oil imports.

The background of the present program is, I believe, significant, and should be outlined briefly.

In July of 1954, President Eisenhower established the Cabinet Committee on Energy Supplies and Resources Policy. The effect of a constantly rising level of oil imports on domestic petroleum production was one of the primary reasons for creating that body.

On February 26, 1955, President Eisenhower approved the findings of this Committee that national security would be threatened, unless oil imports were kept in balance with domestic production at the ratio which existed in 1954.

To prevent this threat to the safety of our nation, oil importers were requested, on a voluntary basis, to curtail imports of crude oil. Other and mandatory methods were considered and rejected on an individual basis, as being much less preferable. Among those were the imposition of tariffs which would in turn raise the very difficult problems associated with Reciprocal Trade Agreements and most favored nation clauses. A quota system was also considered and rejected, as the establishment of quotas almost always inevitably leads to the necessity of price regulation, something that should be shunned if at all possible during peacetime.

The voluntary method worked with reasonable success until the middle of 1956. At that time, importing companies indicated their activities would increase sharply during the last half of 1956 and the first half of 1957. These larger imports would have been substantially in excess of the proportion recommended by the Cabinet Committee. However, the Suez crisis, which halted oil movements through the Suez Canal and created a strong demand for U. S. oil in Western Europe, made action to restrict oil imports unnecessary at that time.

Last March, when it appeared that the normal worldwide flow of oil would be resumed, importing companies were again requested to provide estimates of their activities for the remainder of 1957. These estimates were considerably higher than those previously submitted, and indicated, furthermore, that the upward trend might become even more serious.

The Special Committee to Investigate Crude Oil Imports, appointed by the President on June 26, 1957, studied the problem carefully. This group consisted of the Secretaries of State, Defense, Treasury, Labor, Commerce, and Interior. It found that the proportion between imports and domestic production would rise to 16 percent, although the ratio was 11.3 percent in 1954. As a result, on July 29, 1957, the Committee recommended a voluntary limitation of oil imports to insure a proper balance in relation to domestic production.

(*Continued on page 124*)

THE IMPORTS QUESTION . . .

as seen by an "established" importing company

By Henderson Supplee, Jr.
President, The Atlantic Refining Co.

ATLANTIC has accepted the invitation of WORLD PETROLEUM to submit a statement on the complex and controversial issue of crude-oil importation because—

1. We hope the statement will be a helpful contribution.

2. Atlantic is in a unique position in its relationship to the most important factors bearing on the problem.

To illustrate this second point, the following amplification is offered:

1. Atlantic's domestic crude-oil position is very similar to that of many independent producers in the Southwest who are feeling the effects of increasingly severe proration. Nearly 80% of Atlantic's domestic production comes from Louisiana and Texas.

2. At the same time, Atlantic is a "traditional" importer. We have brought foreign crude oil into our East Coast refinery since before 1920.

Our own foreign crude-oil exploration began about the same time. We were active in the early days of production in Mexico, and exploration cost us many millions in Venezuela, Cuba, and Haiti before our efforts were extended elsewhere in South America and the Middle East. We are just beginning to get some encouraging production in Venezuela, and we are a long way from recovering the capital we have risked for foreign crude exploration.

3. We are the only so-called major integrated company whose products market is confined exclusively to the explosively competitive East Coast. Therefore, we have a completely sufficient appreciation of the domestic industry's concern over "cheap foreign oil."

Now, referring to our first reason for supplying this statement—despite our ample exposure to the reasons for extremist points of view, this very experience convinces us that the only hope for sensible solution lies in reasonableness, moderation, and understanding.

In spite of its complexity, the import problem can be cut down to size if we are willing to accept one basic assumption: namely, that "the easy oil has been found" in this country. This is the point of view expressed broadly by experienced people in our producing industry. It is not to be interpreted in the pessimistic extreme of meaning that our finding potential has been exhausted, but we have convincing proof that even more ingenious finding tools and more expensive drilling will be required to add any substantial volumes to our domestic reserves. By contrast, the world outside our borders offers opportunities where "easy oil" can be had for the drilling—and in volume prolific beyond this country's ability to match. Therefore, our assumption must conclude wtih a question: What possible economic justification can there be to ignore the ready potential outside this country?

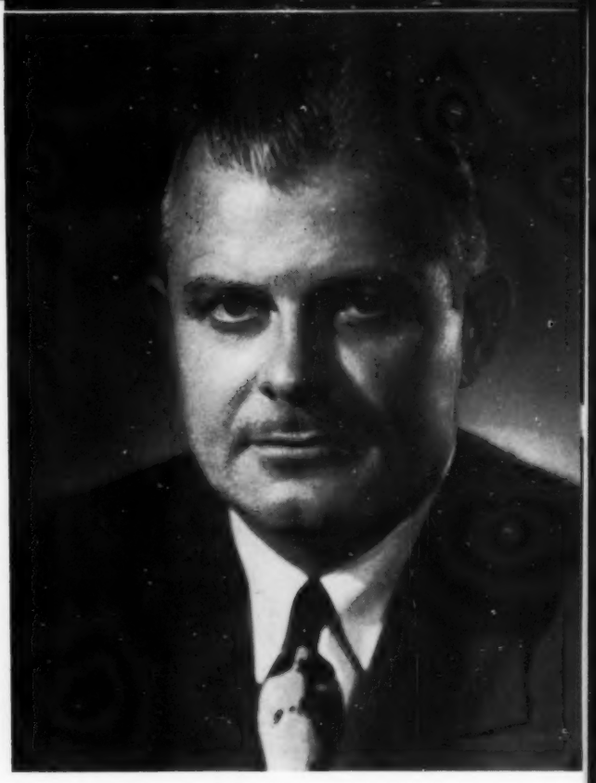
If, now, we proceed to the logical conclusion that consumer interest at home and abroad can be served only by exercising opportunities for worldwide exploration, we find ourselves confronted with the horns of our dilemma. As the industry has gone abroad, it has been rewarded sometimes bountifully by crude-oil discoveries. But, the United States remains the world's top oil market and, therefore, rewards for finding crude are possible only as this market remains available. Hence, of course, we encounter the conflict of foreign and domestic crude competing for the choicest market.

So, we must answer more questions. For example, who is to enjoy access to the domestic market? Common sense dictates that no time be wasted in discussion of whether only domestic producers should participate. That one is answered by our rugged experience in trying to add to our domestic reserves. Shall we then practice a limited restriction by giving the "early birds" the sole privilege of bringing to this country their discoveries of foreign oil? Again, let's not waste time. The laws of economics and the laws of the land would never tolerate that kind of restriction. Companies having access only to increasingly expensive domestic crude would, of course, find it impossible to stand up against their importing competitors, and the industry

(Continued on page 124)

THE IMPORTS QUESTION . . .

as seen by a "new" importing company



By K. S. Adams
Chairman, Phillips Petroleum Co.

IN commenting on an oil import policy, it is essential first to know the premise on which the policy is based. Of the many premises which may be assumed, there are really only two important ones, and they are incompatible. One premise is that there is absolutely no chance of an international emergency arising which would justify framing U. S. import policy to afford maximum protection in event of such an emergency. The other premise is that the consequences of some international emergency, such as the Suez crisis, demand that an absolutely dependable source of crude, together with required transportation and processing facilities, must always be in readiness to supply our emergency needs. In the interest of national defense, the government has based its import policy on this latter premise.

The government recognizes that some imported oil is desirable, but its problem is to determine how much oil can flow into this country from foreign sources without threatening our nation's security.

Domestic oil, the bulk of it produced under conservation practices of proration, can not compete with an unrestrained flood of low cost foreign oil. Of course, if these conservation practices, effective only in this country, were scrapped there would be so great an initial flood of oil that a collapse of the petroleum industry would ensue, just as occurred in the early thirties. This would effectively snuff out the last spark of incentive any person or company might have to invest in additional leases, the drilling of wells, secondary projects to increase oil recoveries, and the continued operation of many marginal wells. After a short-lived feast, the famine would take over, and in case of a national emergency we would be unable to supply our needs.

The entire oil business, from well to shipping terminal, has to be continually expanded and kept in active operation to be able to furnish increasing demands for usable products in the form and at the places they may be needed in an emergency. Suez showed what little help crude oil in the ground can be when it isn't in the right place when needed. Many producers found themselves with crude oil that would respond to the opening of the flow valve on a moment's notice, yet much of it never helped in the emergency because the transportation facilities could not carry it in the abnormal direction of the emergency need.

Some would say that our government should be given absolute power to control imports at all times. Government is only people, and it is not likely that people not intimately and continuously engaged in the day to day operations of the oil business could arrive at any better, if as satisfactory, solutions as can the many oil companies, domestic and foreign, whose own differing economic interests serve as checks and balances. If the international relations aspects of the import problem could be completely eradicated, solving it on the basis of economics and social benefits would be a lot simpler.

In view of the many interests and problems associated with Reciprocal Trade has been initiated a program aimed at effectively and equitably controlling imports. The present government position avoids control yet creates an atmosphere of reasonable restraint over the flow of imports. It was designed to maintain a healthy domestic industry, and to avoid upsetting the international situation. It has not come about by "shooting from the hip." It is the result of much deliberation by industrial leaders, international experts, and governmental authorities. Barring possible inequities, which are being given further study, it is perhaps as good a stop-gap solution as could be devised, but when and if a greater degree of international stability arrives, a more applicable program or formula might be developed.

Whatever long-range import program eventually emerges, it must be geared to meet shifting conditions. These may be likened to the unforeseen situation a field general faces in the course of a war. The solution to such situations has to be formulated after it is know what the situation is. No general can unswervingly follow a

(Continued on page 125)

THE IMPORTS QUESTION . . .

as seen by the domestic producer

By Russell B. Brown, General Counsel
Independent Petroleum Association of America

THE question of oil imports has a direct bearing on every problem now before the oil industry. A permanent solution of this one problem deserves the most careful attention of all segments of our industry.

The national government and many of our state governments have an interest which includes, but is not limited to, the economy of the domestic industry.

Our supply of natural gas, in which there is an increasing interest, will be greatly influenced through the solution of this problem. Exploration and development efforts for both oil and gas are directly affected by imports of foreign oil.

The tax laws, under which the domestic industry has developed, will be either sustained or varied in accord with the policy of maintaining a strong domestic industry.

The questions of proper price relationships and of monopoly in oil are greatly influenced by the competitive force provided by the great numbers engaged in the domestic industry which could be undermined by excessive imports.

These are but a few of the problems which now demand the attention of the companies and people who constitute our industry. The solution of the import issue would enable better planning and work by all.

The question of public acceptance of our industry which is so vital to whatever we do would be greatly facilitated if the issue of imports could be resolved and thus relieve the great friction now created through this problem.

Legislative support for the many industry problems could be greatly increased.

Import issues are clear; they have had the attention and study of the industry, our state governments, and the legislative and administrative branches of our federal government.

The conclusion that our national welfare is best served through a strong, virile, and competitive domestic industry in the USA has been reached through long and careful study by the great majority of the industry. This conclusion has been reached as well by the national legislative bodies. It is well reflected in the long study given the subject by the President's cabinet committee studies and reports.

The latest report based on these studies and approved by the President stated in part:

"The problem of oil imports, and their effect upon the domestic petroleum industry, was one of the primary reasons that caused President Eisenhower to establish the Cabinet Committee on Energy Supplies and Resources Policy in July, 1954. The President directed the Committee to study and evaluate all factors pertaining to the continued development of energy supplies and resources in the United States, 'with the aim of strengthening the national defense, providing orderly industrial growth, and assuring supplies for our expanding national economy and for any future emergency.'

"It is clear that there is a direct relationship between the nation's security and adequate and available sources of energy. Oil and gas account for two-thirds of all the energy that is consumed in this country. Furthermore, there is no adequate substitute in sight for the foreseeable future. Therefore, we must have available adequate supplies of oil.

"We have concluded . . . that if we are to have enough oil to meet our national security needs, there must be a limitation on imports that will insure a proper balance between imports and domestic production."

The Committee concluded:

". . . if we are to have a vigorous program of exploration in this country by private enterprise in order to care for increasing domestic consumption and to meet emergency needs, and if we are to know what our reserve potential is in this country, it is essential that we follow a policy which will encourage continuation of free enterprise exploration at a rate consistent with the demands of a growing economy."

"Your committee recognizes that there are important foreign policy aspects to the problem of limiting petroleum imports. The

(Continued on page 125)

THE IMPORTS QUESTION . . .

as seen by the oil conservationist

By General Ernest O. Thompson
Texas Railroad Commissioner

IN the beginning, let me make clear that by conservation in the production of oil and associated gas I mean those methods and techniques which will give the greatest utilization of the energy which moves the oil through rocks to and up the well bore. I mean all those methods which ultimately will result in the recovery of the greatest possible amount of oil from the reservoir and leave the least possible oil in the sands and rocks never to be recovered by known methods.

Our Texas statute says that marginal wells shall not be restricted. This is in recognition of the economic fact that stripper wells must be kept in production as long as it is economically feasible. The state thus encourages operators to hang onto each well as long as the wells can pay for their keep. Once abandoned and the hole plugged, the remaining oil is lost forever to man's use.

Then, besides marginal wells, we have many wells making a large percentage of water which cannot be reduced in production without killing the well.

To encourage the search for new oil, we allow a more liberal production for newly discovered fields to the first five producing wells, or for 18 months, whichever is the shorter. We need exploration. We know of no better way to encourage exploration than by rewarding successful efforts. This keeps hope eternally alive in the wildcatter's heart in his search for new oil fields.

It is difficult for me, as an administrator, to rationalize the thinking of those people who seem to want to find a new way to penalize or reduce the allowable production of the already hard-pressed oil operator. We in Texas are already shut down 18 days in a 31-day month and 17 days in a 30-day month due to the supplanting of domestic crude by imports in our oil market demand.

In 1938 the United States exported 531,000 b/d and imported 149,000 b/d. By 1947, exports were 436,000 b/d, and imports 453,000 b/d. Today, in 1957, imports have risen to more than 1.6 million barrels per day.

Not only is the volume of imports great, but also the percentage of increase has stepped up alarmingly.

It is easy to understand why USA refiners and marketers of oil in the United States desire to import foreign crude. It costs less.

But national-security considerations demand that we keep alive our own oil-producing capacity if we are to remain strong. In the long run, also, we would pay dearly through the nose once we became dependent on foreign oil, even for our own peacetime requirements. Two-thirds of our USA energy is supplied by oil and gas. Look at the price of gasoline in France to see what it costs a nation to be dependent upon foreign oil. Of course, they put a heavy tax on gasoline; but it sells for about one dollar a gallon at the pump to the local customers. I believe special concessions in price are made to dollar-converting tourists to encourage tourist trade.

When the Suez Canal was closed to traffic, most of Europe was shown to be dependent on imported oil. Had there then been a war involving the great powers, doubtless there would have been many tankers sunk and great losses to those depending on the oil brought by tankers to European shores.

No better explanation of this risk can be found than that given by President Eisenhower at his press conference of July 31, 1957. A reporter asked whether it was safe to exempt our West Coast from import controls when much of the West Coast oil supply comes by water. The President replied, "Well, I will only say this. The whole present approach to this business of controlling our oil imports, regulating oil imports, arises out of one thing: Consideration of the national security.

"As a straight economic or as a straight political question affecting our relationships with other countries economically and commercially, it probably is not a good thing to touch, we ought to deal otherwise. But the national security demands this: A

(*Continued on page* 125)

API Division of Marketing

The API Division of Marketing is attacking problems fundamental to this division of the industry—including attracting capable personnel to this branch of oil, product research, and many others.

Dwight T. Colley, vice president and general manager of marketing for The Atlantic Refining Co.; 1956-57 API Vice President for Marketing.

J. G. Jordan, vice president for marketing, Shell Oil Co.; 1955-56 API Vice President for Marketing.

Left is Dr. John W. Frey, at the time of his retirement as director of the API Division of Marketing, with Adam J. Rumoshosky, Dr. Frey's successor.

WHEN "Doc" Jordan finished two one-year terms as vice president of the Division of Marketing of the American Petroleum Institute, the report he made to the Board of Directors not only spelled out the reasons for the division's existence, but also indexed its character and personality with a minimum of words and a maximum of meaning. Said Jordan (known more formally as J. G. Jordan), vice president of Shell Oil Co., New York:

"There must be an organization where the problems in petroleum marketing can be presented—fully, fairly, and factually.

"There must be a mechanism where differences and conflicts and controversies can be brought into the open, and the pros and cons allowed to speak for themselves.

"Only through such a mechanism can the industry adjust itself without a constant appeal for legislation and hearings and investigations, all favoring one group over another and, in the end, favoring no one."

Jordan emphasized that the API Division of Marketing should not be taken lightly; that it no longer can be considered as "just a bunch of salesmen asking for a couple of thousand dollars for some pointless project." To the contrary, he said, marketing has the most critical, threatening, and divisive problems in the industry today; and the success or failure of a cooperative forum, such as the API Division of Marketing offers, may determine the future of the industry itself.

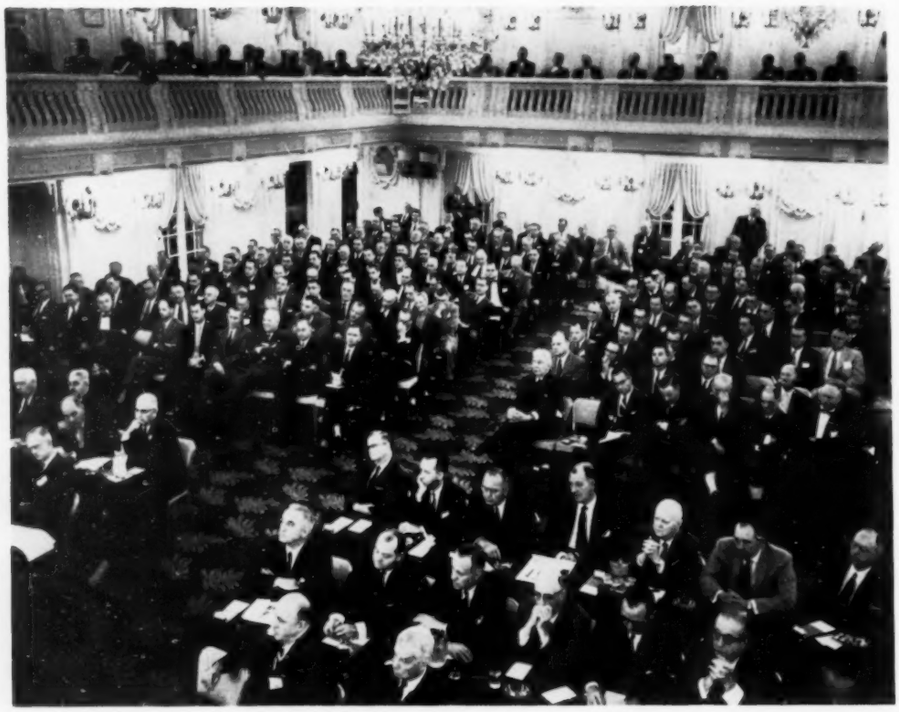
Jordan since has been succeeded by Dwight T. Colley, vice president and general manager of marketing for The Atlantic Refining Co., Philadelphia, Pa., in the API vice presidency. Not only does Colley endorse Jordan's philosophy; he pinpointed it even more by announcing that the objective of the division, during his tenure in office, would be to "serve as a forum for the discussion and exchange of ideas among all marketing and related branches of the petroleum industry in order to promote a better mutual understanding of the problems peculiar to each other."

How well this objective has succeeded can best be summarized by the comment of Division Director Adam J. Rumoshosky, at a meeting of the Colorado Petroleum Marketers Assn. in September. Said Rumoshosky, in effect: Suppliers and jobbers alike have made a great deal of progress in the past year because both have been more understanding of one another's problems.

The Institute's Division of Marketing is one of the oldtimers, as far as the record books go; but, only in the recent postwar years, has it had any virility, substance, and meaning to the thousands upon thousands of persons engaged in distributing petroleum products.

The division was established in December 1929—almost three decades ago. In its earlier days, it experienced a flurry of activity. Among other things, it administered the Institute's work on gasoline-tax evasion, and the old NRA petroleum-marketing code.

But, for all intents and purposes, it lay dormant from the late '30's through World War II. During most of this period, the API board didn't even set up a budget for its expenses. By the end of World War II, however, wise and farseeing marketers urged the Institute to reactivate the division. There was a feeling that, even though the scope of its operations would be re-



Crowd shot of the Division of Marketing in session during the API Annual Meeting in Chicago, November 1956.

stricted severely by laws and regulations, there were areas in which the division could do constructive and worthwhile work.

It was not until the middle 1940's that new life was breathed into the marketing division. In 1947, Dr. John W. Frey was engaged as a full-time staff director—the first time the division ever had more than token personnel. Division headquarters were set up in the API's Washington office, and remained there until 1954, when Dr. Frey retired. In his place came Adam J. Rumoshosky, a veteran employee of the Institute. Marketing-division headquarters were transferred to the New York API office, and the whole organization has been expanding and developing rapidly ever since.

The Division of Marketing today is a substantial part of the Institute, both in terms of size and vigor. It has, for example, doubled its membership in recent years—from 900 persons in 1950 to approximately 2,000 now. In keeping with the diversified character of the marketing branch itself, this membership is drawn from all segments —retailers, jobbers, commission wholesale distributors, brokers, cooperatives, independent refiners and integrated suppliers, and many others.

There are now 15 functional committees working under the General Committee of the Division of Marketing. Of these, only four—the Nominating Committee, the Program Committee, the Lubrication Committee, and the Aviation Technical Service Committee—were in existence before 1949.

The division activities are in five general areas, as follows: (1) personnel recruiting and training; (2) product promotion; (3) scientific marketing through research; (4) standardization of equipment; and (5) marketer management aids.

A sixth area, the field of intra-industry relations, encompasses the five areas above, and comprises practically every major and subordinate activity of the marketing division.

1. *Personnel:* One of the most serious and pressing problems existing at both the retail and wholesale levels of the petroleum industry is the need to attract high-caliber young men into careers in petroleum marketing. One of the causes of this problem at the retail level is the low prestige rating of the service-station occupation. The roots of this problem are being studied by a committee of suppliers, management personnel, and service-station dealers as to what can be done to raise the prestige of service-station personnel.

Perhaps one of the most promising programs in this area is the marketing division's interest in the distributive education program for training high-school and junior-college students for careers in the service-station business. Distributive education is a public-school program, at the high-school and junior-college level, in which students prepare for careers in retail and wholesale distribution on a part-study, part-on-the-job training basis.

In support of this program, the marketing division has cooperated with the University of Texas in the preparation of a joint API Marketing Division-University of Texas Course in Service-Station Operation and Selling to be used in these high-school distributive-education programs through the country. This course draws on all training materials in the petroleum field to assure accuracy and completeness, and is one of the finest available to any industry in the D-E retail field.

The Division of Marketing also has engaged Brice W. Cecil, former assistant state supervisor of distributive education, Texas Education Agency, Austin, to assist in planning and coordination of this program on a national basis.

While relatively new, it is expected that this D-E program will provide a continuing source of well-trained high-caliber personnel for careers in the future retail and wholesale marketing of petroleum products.

The division also has encouraged "training-for-management" programs by state oil-marketer associations, both at the retail and jobber levels. In support and promotion for this program of dealer and jobber management institutes, sponsored by state retailer and oil-jobber associations—in conjunction with various state universities—the division's Personnel Training Committee has prepared and published a series of proceedings of these institutes to be used as possible aids in organizing, planning, and holding of future institutes.

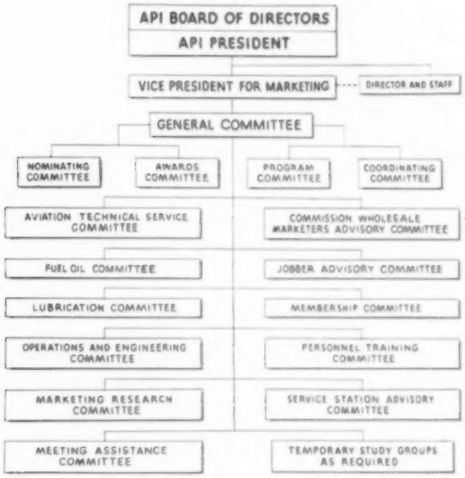
To give an idea of the scope of this program, 62 jobber management institutes, usually lasting about three days each, have been held in 25 states since 1952, each attended by from 10 to 30 jobbers. At the same time, 51 oil companies have provided speakers for these institutes, while other sources for speakers have included: manufacturers, banks, investment companies, insurance companies, management consultants, attorneys, etc., as well as professors and lecturers in business management, marketing, finance, etc., from the universities at which the institutes are held.

2. *Product Production:* Two marketing-

In the Laboratory: Part work and part study in the Division of Marketing's Distributive Education Program.

ORGANIZATION OF THE DIVISION OF MARKETING

AMERICAN PETROLEUM INSTITUTE



division committees are in the nature of product committees, in that they are engaged primarily in technical and marketing problems as related to increased consumption of petroleum products.

The division's Fuel Oil Committee is concerned primarily with problems arising from the competitive struggle between heating oil and other competitive fuels for the home-heating market. This committee has served as a thought-leading group in pointing out that distillate fuel oils are profitable to all segments of the industry and in developing the need to promote oil-heat aggressively in order to preserve the future of the distillate market in light oils.

The formation of the activity known as "Oil Heating Market Reports," to study the various local markets for heating oils and to develop information to be used at the local level in promotion of oil heating for the home, has been attributed to the work of the Fuel Oil Committee of the Division of Marketing.

In addition to conducting studies on the extent and responsibility of local fuel-oil marketers to provide seasonal storage for distillate oils, this committee also has published literature on "How to Save Money with Oil Burners," and has conducted forums on hundreds of subjects ranging from heating-oil budget plans to advertising and promotion, the sale of oil-heating equipment and air conditioning with oil fuel. The primary purpose of these activities is to have the committee serve as an educational forum in encouraging fuel-oil marketers to expand and improve the fuel-oil market and fuel-oil marketing.

Students with their teacher in the practical application of service-station operation, as part of API Division of Marketing's Distributive Education Program.

Another marketing-division group—the Lubrication Committee—has done, among other things, considerable work to promote sensible automotive crankcase-oil drain policies. In recent years, the automobile manufacturers have tended to recommend longer and longer intervals for crankcase-oil drains for their cars. The Lubrication Committee, by presentation of sound, carefully-researched technical and operating data—challenging the so-called economy of such recommendations—has been a strong, steadying influence in this field. Working with automotive, aviation, and industrial manufacturers and users of lubricants, the Lubrication Committee has been a major influence in developing and encouraging the use of other sound lubrication practices and policies.

For example, in connection with chassis lubrication, many automobile manufacturers have tended to urge that their cars be lubricated less frequently and to foster the use of self-contained lubricants, but the Lubrication Committee has been able to demonstrate the wisdom of preventive maintenance by "lubricating for safety every 1,000 miles" by the car owner in savings on automotive maintenance and repair bills.

In addition to its traditional annual winter meetings with automotive-industry engineers and designers in Detroit, another

major activity of the committee has been to offset the tendency of car manufacturers in recent years toward sealing in an initial chassis-lubricant fill for the lifetime of the car and to discontinue the installation of rear-axle chassis drain plugs. The Lubrication Committee has presented technical data to point out the dangers of such practices, and many car manufacturers are beginning to restore the drain plug to permit refills. These activities have a real dollar-and-cents value to wholesale and retail marketers, suppliers, and independent refiners, as well as to the oil compounders and marketers.

3. *Scientific Marketing through Research:* Another major activity of the marketing division is research in the field of marketing operations, such as studies in product-loss control, more efficient dispatching, how to reduce service-station construction costs, the economies of seasonal storage for local marketers, and the effect of paint colors in reducing storage-tank losses.

Research in marketing operations is being undertaken on tight-fill connections for gasoline deliveries, remote pumping of gasoline at service stations, and the possibility of encouraging the production of a safe and efficient automatic hose nozzle for gasoline pumps at service stations.

In the related field of marketing research, so that more effective selling and marketing programs can be planned, the marketing division has gathered statistics on how much families in different income groups spend for automotive transportation, including petroleum products and TBA (tires, batteries, accessories) items. The division's Marketing Research Committee has studied the motor-oil and lubrication purchasing habits of consumers throughout the country.

This committee has made very informative surveys on the farm market for petroleum products, and the market for cutting oils by the steel industry. This committee also has contributed research on the measurement of service-station trading areas, the use of maketing research in management planning, planning capital investment in marketing facilities, a pilot study of service-station operating costs, and information on the size and nature of the petroleum commission wholesaler business.

The division is doing, and expects to do, a lot more to learn about what, when, and where consumers spend part of their income for petroleum products. These activities, too, are designed to help both integrated and independent marketers cut their operating costs, and to provide a basis for more aggressive, more intelligent, and more profitable marketing.

4. *Standardization of Equipment:* Recently the division embarked on a program of standardizing sizes and other fundamental nonoperating features of marketing equipment. The purpose of this standardization program is to develop basic units and dimensions for marketing equipment to facilitate replacement and reduce construction, installation, maintenance, and repair costs—without, however, any restrictions as to differences in general plan or operating costs, procedures, or principles which are in the realm of competition between equipment suppliers and manufacturers.

As an example of this activity of the marketing division—through discussions and cooperation with the Gasoline Pump Manufacturers Assn.—the location of bolt holes and suction stubs to gasoline pump bases is expected to be standardized by all manufacturers so that the changing of pumps at service stations will become a relatively simple matter as compared with the past. The division also is working with the manufacturers of underground tanks to standardize on certain sizes which will enable the manufacturers to cut down their inventory and produce manufacturing economies which can be passed on to the marketers. The division also is studying the possibilities of standardizing terminal and bulk-plant piping and fittings.

These activities will be measurable in dollars and cents in the retailer's or jobber's pockets, and to the stockholders in the integrated and independent refiners and marketers, in the form of lower construction, repair, and maintenance costs, and competitive replacement by manufacturers and suppliers of marketing equipment.

5. *Marketer Management Aids:* There are a number of other API marketing projects which have been completed, or are in the works, which are intended to be of assistance to jobbers and dealers as well as to integrated suppliers and the independent refiners and marketers.

For example, several years ago the marketing division issued a jobber accounting manual which was adopted by several jobber groups and widely promoted and used in jobber circles. Another current project of the division now in the works is to develop a factual information to assist jobbers in approaching potential lenders and investors to obtain long-term financing for business expansion.

The division is also considering a proposal that a Highway Advisory Committee should be formed to conduct economic studies and analyses of the general effects on marketers of the federal highway program, and to provide a forum for the discussion of marketing problems raised by the federal highway program. This committee is expected to be of particular value to jobbers and dealers, and to independent refiners and marketers and many of the smaller companies which are not able to conduct their own studies and analyses of these problems and who will expect to look to the API—particularly the Division of Marketing—to provide such services.

In recent weeks, the division completed a survey as to the nature and extent of crimes committed against service-station personnel and service-station property, so that a sound and economically feasible plan can be undertaken to reduce such crimes.

A number of other marketing-division projects in the service area, such as the training of tank-truck drivers, service-station safety and accounting methods, and the organization of petroleum-marketing research activities, are either completed or in process.

Intra-industry Relations: The committees in the Division of Marketing which have attracted the most interest are the Jobber Advisory Committee, Commission Wholesale Marketers Advisory Committee, and the Service-Station Advisory Committee. The purpose of these advisory committees, as defined in their charters, is to foster an understanding of one another's problems by jobbers, dealers, commission wholesalers, and suppliers.

These committees have sponsored a number of concrete projects of interest and value to marketers such as, for example, with the Jobber Advisory Committee, the training of executive personnel for jobber replacements, estate planning for continuity of the jobber franchise, and a study of sources for long-term jobber financing. However, much of the activity of these committees in the field of intra-industry relations has been talk.

The chief objective of these committees, with a membership divided between jobbers, commission wholesalers and dealers, on the one hand, and supplying company representatives on the other, is to encourage a better understanding of their mutual problem and to open up a direct channel of communications between jobbers, dealers, and commission wholesalers and executives in charge of marketing of their supplying companies.

These advisory committees are specifically forbidden to discuss or recommend the adoption of any agreements or courses of action with respect to prices, margins, allowances, sales territories, or other similar marketing policies relating to price and commercial competitive practice. However, they do provide a sounding board where jobbers and suppliers, dealers and commission wholesalers, can present the facts and different points of view as to various aspects of their joint problems. These committees are not designed to arrive at specific agreements, but to stimulate the thinking of those in attendance to see all sides of a problem, so that properly informed, individual decisions can be made on a reasonable and equitable basis. An index of the emphasis placed on the field of intra-industry relations by the division is a statement by Vice President Colley, in which he urged marketers to be realistic and recognize that not all of the complaints and difficulties brought out in congressional hearings or investigations "are imaginary or unavoidable."

"The strong should be quick to help the little guys," Mr. Colley said, "especially the dealers who are completely on their own." With a philosophy and leadership like that, the API Division of Marketing can only go in one direction: upward. END

The present outlook for tanker markets

by Walter J. Levy

**During the past year the world tanker market has turned full circle. This time a year ago tonnage was fully utilized and rates were strong; in succeeding months a frantic scramble for tonnage caused by the Suez crisis boosted rates to record highs; since then the supply of tonnage has become excessive and rates have fallen to depressed levels. This abrupt turnabout has called attention once more to the vagaries and fluctuations of the tanker market; more than ever it has stimulated interest among owners and charterers in what may be expected to take place in the market during the years ahead.*

Forward estimates of both supply and demand of tanker tonnage present problems of unusual complexity, because of the intricate interplay of the influences at work in the tanker market. A constant interaction between tanker tonnage and tanker requirements must be contemplated in assessing the future outlook for tanker markets. A projection of the supply and demand for tankers and resulting surplus or deficit at some future date, based upon any set of assumptions, should not be regarded as a forecast, therefore. It can be most useful if it is designed so as to provide an evaluation of emerging trends—the timing of potential surplus or deficit, the probable impact on tanker rates and valuations, and the direction of adjustments in both tanker supply and demand that would ensue.

The analysis that follows suggests that a relatively large tanker surplus may be with us for some time to come, assuming, of course, that a new crisis in the Middle East or other complications which might affect oil flows through the pipelines and the Suez Canal do not occur. We would not expect that the huge tanker surplus that is indicated for 1960 will in fact develop, however. We would expect that the potential surplus that is emerging will have a significant impact on tanker markets, and hence on future adjustments in both the supply and demand for tonnage. The implications for tanker rates and tanker valuations could be especially significant to companies which have considerable discretion in the manner and timing with which they cover future requirements.

Walter J. Levy

SUPPLY OF TONNAGE: Changes in tanker tonnage depend on gross additions to the fleet through new construction and withdrawals occurring from scrapping and conversion to dry cargo vessels. Latest information on the schedule of future deliveries of tonnage under construction and on order indicates a rise from slightly less than 400 T-2 equivalents in 1957 to as high as 524 in 1959, followed by some tapering off to 498 in 1960 (as against actual deliveries of 227 in 1956 and a postwar peak of 298 in 1954).

It appears quite unlikely, however, that the amount of tonnage scheduled for delivery during the next 3-4 years will actually be completed. The National Petroleum Council in a recent study indicated that, because of a variety of factors, it did not believe actual deliveries could rise above 300, on the average, through 1965. On the other hand, a leading London tanker broker, John I. Jacobs & Co., Ltd., considers that a steady increase of deliveries from 358 T-2 equivalents this year to more than 440 in 1958 and 1959 would be reasonable.

It is, of course, impossible to predict a really accurate figure of future deliveries. Previous experience indicates, however, that the capacity of yards is actually highly flexible in periods when a large backlog of orders is available. Up until recently, owners with vessels under construction were willing to meet extra charges in order to speed up the delivery of their tonnage. Now, however, with tonnage in surplus they may be reluctant to pay premiums. The rate at which the backlog of tonnage under construction and order is converted into deliveries may, therefore, tend to slow down.

An accurate forecast of withdrawals from the fleet is perhaps even more tenuous than one of additions. On the basis of the physical life of tankers it is possible to establish a range of withdrawals, assuming that all 25-year old vessels will be scrapped, or alternatively that scrappage will occur at 20 years. The differences between these two schedules are comparatively small until 1961, but become extremely large thereafter when the large fleet of T-2's built during

* *This article is based on a broader study of the tanker market, many details of which have necessarily been omitted.*

World War II will move into the 20-year category.

Disregarding for the moment the effect of future economic considerations on the rates of gross additions to and withdrawals from the tanker fleet, the potential supply of tonnage, on alternative bases, is shown in the accompanying table. The size of the tanker fleet is not projected beyond 1960, since the effect of new orders and cancellations upon construction backlogs and the rate of scrappage would by then be more affected by interim economic developments than by present considerations.

Tanker Requirements: A projection of future tonnage requirements involves the forecasting of increases in petroleum demand in major consuming areas, expansion of production in principal producing areas, the resulting intra- and inter-regional oil flows, and in some instances, the choice as among alternative transportation methods and routes. The following estimates are designed merely to yield a working model against which the order of magnitude of potential tanker shortages or surpluses can be approximated. Since the underlying assumptions are not intended to be predictions of actual patterns of future demand, the extent to which tanker requirements would vary under alternative assumptions is also explored.

The projections are formulated in terms of average annual growth rates for the period 1955-1965, since many of the available estimates of future growth are built around this ten-year period. The projection of demand for the United States is based on forecasts by the Chase Manhattan Bank and assumes an average growth of 4.3 per cent; for Western Europe 8 per cent, which is in line with the projections of the OEEC Oil Committee, has been assumed. For other areas (Canada, Latin America and the remainder of the Eastern Hemisphere) little information on probable consumption trends is available, but an average growth rate of about 7 per cent per year—implying a doubling of demand over a decade—appears to be a reasonably conservative expectation. No attempt has been made to allow for variations in these rates, as between the early or later years; or to anticipate year-to-year fluctuations around the long-term growth trend, although these are bound to be substantial.

As regards supplies of liquid fuels, it has been assumed that (a) U.S. production will reach 9.9 million barrels a day in 1965, in line with the estimates of the Chase study; (b) Canadian production will be in balance with Canadian consumption; (c) Latin American production will advance to 5.0 million barrels per day, owing chiefly to expansion in Venezuela; (d) production in Asia and Africa (excluding the Middle East) will reach 1.1 million barrels per day; (e) the Middle East will provide the remainder of world requirements, resulting in an expansion of production to 7.3 million barrels per day.

A series of further assumptions concerning trade flows and means of transportation are also necessary to establish a reasonable working model. First, total U.S. imports will amount to 3.2 million barrels a day in 1965, with perhaps 600,000 barrels per day moving into the West Coast and the remainder East of the Rockies. At the same time, coastwise shipments to the East Coast are assumed to rise only slightly above current levels, as virtually all of the expanded domestic production will be consumed in inland areas. Second, while Canadian supplies are assumed to be nominally in balance, the country is likely to be both a major importer and exporter of crude oil. For working purposes a figure of 300,000 barrels per day has been assumed. Third, the Caribbean will continue as the largest supplier of U.S. important requirements—1.65 million barrels per day in 1965. However, the United States will draw on Eastern Hemisphere sources to an increasing extent, with shipments rising to 1.25 million barrels per day in 1965. The Caribbean will also supply all of the remaining Western Hemisphere needs, except for 100,000 barrels per day of Middle East crude, assumed to move to Latin America. In addition, shipments of Caribbean oil to Europe and West Africa are assumed to increase slightly to 750,000 barrels daily. Fourth, the Middle East will supply the remaining requirements of Europe (after deducting local supplies) amounting to about 3.65 million barrels per day. Shipments of Middle East oil to Africa, Asia and Oceania will total 1.8 million barrels per day. So far as the westward flow of Middle East oil is concerned, pipeline capacity to the Mediterranean is assumed to increase to about 1 million barrels daily in 1960 and to 1.3 million barrels per day in 1965. The remaining westward movement of Persian Gulf oil is assumed to be through the Suez Canal, implying a virtual doubling in these shipments to 3.3 million barrels per day in 1965. In view of recent events, it may be quite unrealistic to anticipate shipments of this magnitude through the Canal, and some combination of increased pipeline flow plus movement around the Cape is probably more likely.

On the basis of these assumptions, total demand for tonnage for the major trade routes in 1965 would rise 90 per cent from the 1956 level, compared with an increase in world oil consumption of about 70 per cent. Assuming a proportionate increase in foreign coastal movements, for which complete data are not available, total world tanker requirements will rise to 4,310 T-2 equivalents, compared with an average of 2,278 T-2's in 1956. The more rapid expansion in tanker requirements than in world oil demand, which is in line with the past trends, reflects the influence of two factors: (a) a lag of domestic production behind demand in major producing areas, particularly in the United States, resulting in a rising share of imports in total supplies; and (b) a lengthening of supply routes, due primarily to the rapid growth of U.S. import requirements (especially after 1960) and the more than proportionate increase in shipments from the Middle East.

Tanker Supply Balance: By interpolating tonnage requirements for intervening years from the 1965 projection, the trends in tanker tonnage and demand can be compared. The tanker supply balance emerges as follows:

ESTIMATED WORLD TANKER TONNAGE*
(T-2 Equivalents)

	Deliveries		Scrappage		Total Fleet	
Year-End	A	B	C	D	E	F
1956					2,376	
1957	300	358	8	32	2,644	2,726
1958	300	404	4	27	2,917	3,126
1959	300	443	4	36	3,181	3,565
1960	300	447	13	23	3,458	3,999

* For vessels of 10,000 deadweight tons and over.
A National Petroleum Council.
B John I. Jacobs & Co., Ltd.
C 25-year life.
D 20-year life.
E +A-D.
F +B-C.

WORLD TANKER SUPPLY BALANCE*
(T-2 Equivalents)

	Total Fleet			Surplus	
Year-End	A	B	Requirements	A	B
1956	2,376				
1957	2,644	2,726	2,530	114	196
1958	2,917	3,126	2,695	222	431
1959	3,181	3,565	2,871	310	694
1960	3,458	3,999	3,058	400	941

* For vessels of 10,000 deadweight tons and over.
A NPC estimate of deliveries; scrappage after 20 years.
B Jacobs' estimate of deliveries; scrappage after 25 years.

Accepting these figures for the moment, a sizeable surplus of tonnage is already indicated for this year; the excess would about double in 1958, and grow to unprecedented proportions thereafter. Its magnitude may be gauged by a comparison with 1954, the most recent year of deep depression in the tanker market. In that year, the tonnage reported in lay-up rose to a peak of 3.7 million dwt at the end of August, equivalent to an estimated 180 T-2's. These figures do not include all tankers that were unable to find employment as petroleum carriers, since a sizeable number were engaged temporarily in the grain trade, and others were probably idle some of the time without being actually deactivated. Nevertheless, the surplus in 1954, when spot rates in the Caribbean/USNH trade averaged USMC-33 per cent, did not reach anywhere near that indicated for 1958 and later years.

With respect to the indicated surpluses over the years through 1960, a number of considerations should be evaluated, in addition to those that are built into the working model.

Influence of Demand Factors: Should the rates of increase in free world demand exceed those used here, actual tanker needs would obviously be higher than indicated. If, for example, U.S. demand were to in-

Shown is the W. H. Berg, a tanker from the Standard Oil Co. of California fleet, heading out to sea from the company's Richmond refinery inside San Francisco Bay (Socal photo).

crease at an average annual rate of 4.8 per cent, and all of the additional oil were drawn from the Middle East, tanker requirements would be increased by the equivalent of 135 T-2's by 1960. If European demand were to grow at an average annual rate of 9 per cent, tanker requirements for delivering Middle East supplies via Suez would be increased by 65 T-2's by 1960. If other Eastern Hemisphere demand were to advance at an average annual rate of 8 per cent, tanker requirements would be increased by 40 T-2's by 1960. If each of the major areas experiences the more rapid rates of growth, 1960 tanker requirements would be increased by some 240 T-2's. The indicated surplus in tonnage would be reduced but would still remain substantial.

Pattern of World Flows: The routes along which an expanded flow of Middle East oil would move to Europe and North America will have an important bearing on future tanker requirements. No allowance has been made in the initial estimates for shipments around the Cape, although the large-scale ordering of vessels too large to pass through the Suez Canal fully loaded indicates a trend in this direction. To this extent, the projected tonnage requirements would definitely fall short of actual needs. On the other hand, the assumed expansion of pipeline capacity to the Mediterranean may prove to be unduly conservative, although the bulk of any increases may not take place for some years.

Another factor of importance is the future development of U.S. productive capacity and import policy. Import levels below that estimated would not affect tanker requirements significantly if domestic oil (hauled by tanker) were used instead of Caribbean supplies. However, a lower volume of shipments from the Middle East would mean a sharp reduction of tonnage requirements. The construction of pipeline capacity from the U.S. Gulf to the East Coast would also cut appreciably into tanker requirements.

Finally, the gross volume of inter-hemisphere oil flows becomes a major determinant of tonnage requirements. The actual volume of inter-hemisphere flows could be influenced by security considerations with respect to sources of supply. It would depend also on the specific demand in importing countries for crudes of various qualities and for individual products, on individual company positions, on currency considerations, and on competitive factors among which tanker rates are of extreme importance. A tanker shortage with resulting high rates would create an incentive for minimizing long hauls; a tanker surplus with resulting low rates would tend to support a greater volume of cross-hauling. The future pattern of inter-hemisphere oil flows thus defies prediction.

Surplus Tonnage and the Process of Adjustment: On balance, the indicated trends in tanker supply and demand point toward a sustained large surplus of tanker tonnage. The duration and magnitude of a surplus position will, of course, depend on the rate of new tanker deliveries, levels of world demand, and the methods and routes that are available for international oil flows. Once a surplus emerges, the figures on excess tonnage that are indicated in the working model become less significant than the developments that will have been set in motion in tanker markets.

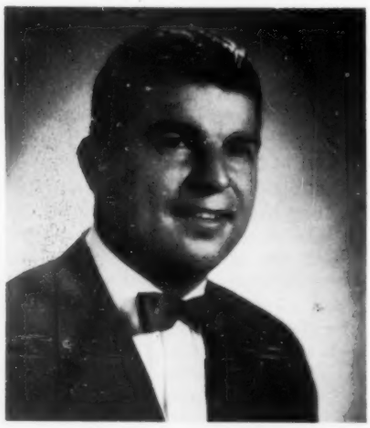
The period of construction required to work off backlogs of new building and the reluctance of owners to scrap or lay-up until the depression of tanker markets becomes overwhelming, make adjustments in the supply of tonnage a time-consuming process. In the interim, tanker rates and tanker valuations tend to move sharply downward. But as excess tanker capacity begins to appear and tanker rates weaken, the indicated rate of growth in the tanker fleet would tend to be slowed down as part of the inevitable adjustment in the supply of tonnage. Actual disappearances will, of course, be determined not only by the physical condition of a vessel but, even more importantly, by economic factors.

The rate of gross additions to the tanker fleet will also be affected by the emergence of surplus tonnage. Not only will new orders be curtailed, but substantial cancellations of orders already placed (but not yet executed) can be expected. Such adjustments will, of course, take time to work themselves out. The severity and duration of the anticipated surplus will be dependent on the complex interplay of all the forces shaping the supply of and demand for tankers, and therefore does not lend itself readily to prediction. If postwar experience may serve as a guide, some 2-3 years could be required to reduce the surplus and set the stage for a renewed strengthening of tanker markets. END

Refinery models aid Kellogg

Before a new refinery was built by The M. W. Kellogg Co., a complete scale model was assembled from prefabricated parts. The company has found this provides the most efficient way of contributing management's experience to the new plant. It also provides the client with an exact view of his order; and in overseas work the model greatly helps to overcome the language barrier.

by B. W. Jesser and Harold Kershaw



BENN W. JESSER received his undergraduate and graduate training at Princeton University, from which he holds B.S. and M.S. degrees. After several years with Dupont, he returned to Princeton as an instructor in chemical engineering. He joined The M. W. Kellogg Co. in 1942 as a job engineer, and has held successive positions in the operating, piping, project, and administrative engineering departments. Until recently, he was manager of design engineering in Kellogg's New York office, and is now a contract operations staff engineer.

Mr. Jesser is a member of ASME, AICHE, NYSSPE, Sigma X, and holds a professional engineer's license in the state of New York. He has recently been active in the engineering law problem, and was a member of the executive committee of the Committee on Engineering Laws.

HAROLD KERSHAW has been instrumental in developing The M. W. Kellogg Co.'s model program as a practical aid to design, to which he is at present devoting his time. He joined Kellogg in 1939 as a piping designer, and supervised the development of Kellogg's "Hydro-Ejector" for handling heat-exchanger bundles. He is co-holder of patents on Kellogg's plug valve for the Orthoflow FCC process.

In 1949, Mr. Kershaw organized the plant-layout section at Kellogg, and was section head of that group until recently. During that time he developed Kellogg's "In-Line" plot layout used in many refineries today—including the recent American Oil Co.'s installation at Yorktown. Mr. Kershaw is well-known for his discussions before engineering groups on plant layout. He is a member of ASME, and author of the paper "Design Models Are Here to Stay," published in *Petroleum Processing*, which describes Kellogg's initial model program. This article is the second report on the company's program.

Models give these benefits:

1. Improved communications.
2. Better design.
3. Facilitate client review.
4. Savings in material costs and field labor.
5. Savings in engineering costs.
6. Shorter calendar schedules.
7. Reduced turnaround time.
8. Savings in maintenance.
9. Improved and safer operation.
10. More rapid training of personnel.
11. Construction planning.
12. Encourage broader contribution to design.

IN planning a new plant investment, major oil and chemical companies and the engineer-contractor face a common objective: That best use be made of the wealth of experienced personnel at their disposal.

Developing a New Communication and Design Technique for Engineering Management: Essentially the problem is one of communication. The senior members of engineering managements of oil and chemical companies, who by experience and talent can contribute most to planning, are frequently occupied with policy-making, decision-making, supervision, and training of personnel. Because of pressures on their time, they are often physically unable to personally review the hundreds of detailed engineering drawings which comprise the design of a new plant. Yet, to protect investment and to obtain the kind of plant which best meets operating needs, management must bring all of its experience to bear.

The engineering-construction organization, on the other hand, must provide the most efficient means for conveying engineering concepts accurately through its own organization and to the investor. As a business, it must constantly strive to improve the efficiency of its engineering services.

A new communication and design technique developed by The M. W. Kellogg Company which meets these requirements is the successful application of engineering models to solve basic problems of communication.

The usefulness of three-dimensional, scale models as a communication and design tool is based on the fact that they provide a better medium for expressing engineering ideas. Engineering concepts can be presented in their entirety, rather than in the bits and pieces of many drawings. Components can be shown in their true proportions and spatial relationships. Equipment locations, piping, structural arrangements, placement of control or maintenance equipment can be readily appraised and evaluated.

Additional evidence of this communication value has been illustrated by models prepared for overseas projects. The problems caused by the differences in design and drafting presentation and techniques have been simplified by the use and reference to the actual model. Furthermore, in cases where language barriers might impede the exchange of engineering ideas, models expedite a common understanding. In one instance the initial planning model depicting the equipment and structural arrangement and basic piping was prepared in Kellogg's New York Office. Portions of this model were then shipped to Kellogg's

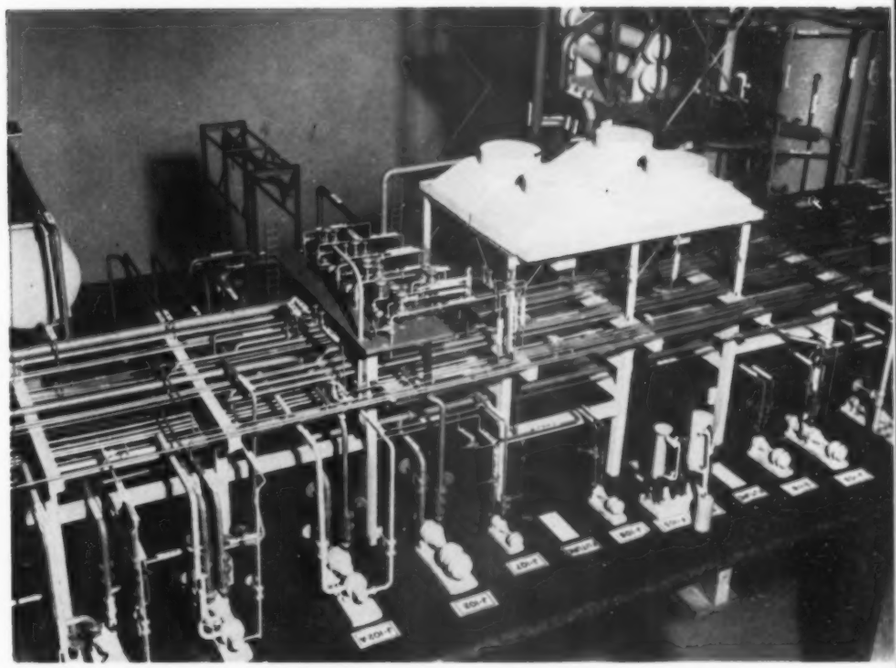
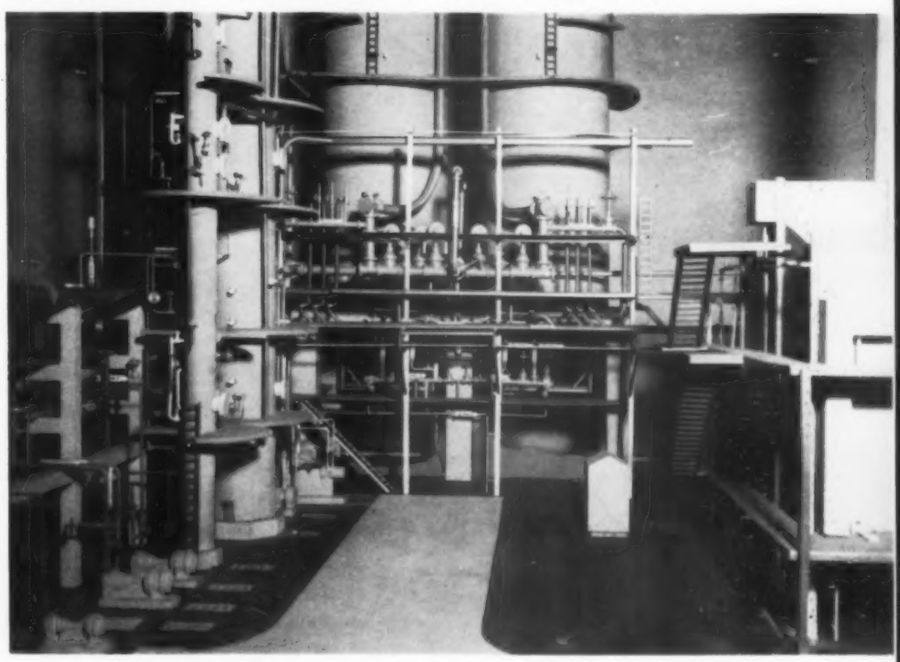


Fig. 1. A space and piping cost problem, resulting from a change from water to air-cooled heat exchangers, was resolved by locating air coolers above the yard bank. Doubts as to the feasibility of this solution were removed when shown on the model.

Fig. 2. Cyclic nature of coking operation requires careful planning for maintenance. Problem was how to obtain the best access arrangement. Original plan, viewed on model, was modified several times to obtain an arrangement acceptable to maintenance groups.



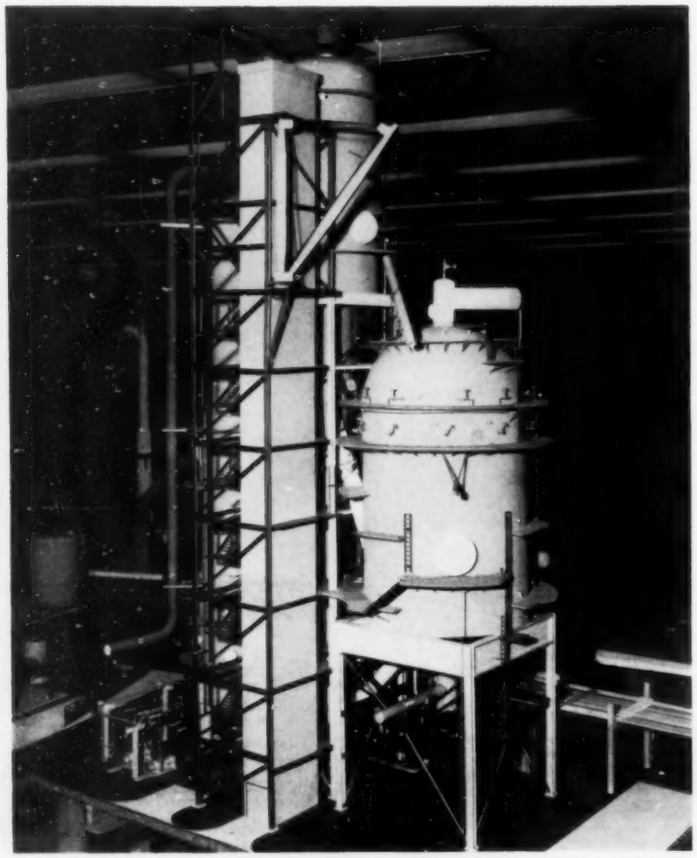


Fig. 3. Better use of maintenance derrick resulted after viewing model. Originally, derrick was intended to service a 42-in. valve. Relocation of manholes and platforms on major vessels made it possible to use derrick for 60 additional heavy accessories which must be lowered to grade for maintenance.

London and Paris offices, where they guided the completion of the detail design and were available for reference and customer appraisal.

Some five years ago, Kellogg began investigating the use of scale models and experimented with various types built by professional model making concerns. The company found that these models were helpful but had certain definite disadvantages. Because of the methods of construction, they could not always be built with sufficient speed to keep abreast of design. Since they were made by outside firms, valuable time was consumed in settling working agreements and schedules and in exchanging design data. The problem of drawing interpretation for the model makers benefit still existed and was complicated by the necessary break-in period to familiarize model personnel with company design practices and standards. The result was that too often models were being built after designs on paper had been completed, thus losing much of their potential value.

Kellogg's early experiences indicated that scale models would be far more useful in improving engineering design and reducing engineering costs if they could be built within the design organization and at a much faster pace.

On this basis, Kellogg initiated a development program directed toward the extensive use of models in order to achieve the following objectives:

(1) Build a functional model; a model that would proceed concurrently with design; a model whose construction techniques would not require specialists; a model that could be easily changed and revised.
(2) Eliminate study and layout drawings by designing directly on models.
(3) Prepare fabrication and construction drawings from models.
(4) Substitute photographs and machine operations for fabrication and construction drawings.

In this long range development program, the ultimate objective is the more efficient design of better refineries and chemical plants. The models are simply a medium for that design and in no sense a product in themselves. Kellogg does not make models except as an engineering approach to adequate and economical process industries design. Models are no more an end in themselves than are drawings, and should be used similarly to convey engineering ideas.

The first stage in this program, development of a simple technique for rapid construction of functional scale models, has been concluded successfully. An example of the results is shown in accompanying photographs.

Kellogg is presently proceeding toward the second and third objectives of this program. The design of a small unit has been completed and the plant is under construction. The results of this first test have been most encouraging in that engineering costs and calendar schedule were well below those that would be expected with conventional methods. The same techniques are now being applied in the design of a large petroleum refining unit.

The fourth step is yet in the experimental stage. If all four objectives are achieved as successfully as the first, Kellogg will have developed a far more efficient method for designing complex industrial plants—a method whereby the client, with minimum effort on his part, may insure that design incorporates all his requirements.

An Unusual New Model Technique: To tie model making closely to design, Kellogg in 1955 set up a complete model building facility at its New York offices and undertook development of a simple, rapid technique for model construction and assembly.

After some experimentation, a single plastic material was selected. Available in colors and in formulations with varying physical properties, the material could be preformed on common molding and extruding equipment.

Plastic model components were designed for simple assembly in the drafting room. Dies were made to permit rapid production of molded parts on commercial equipment. Inventories of stock parts were planned as in an industrial operation.

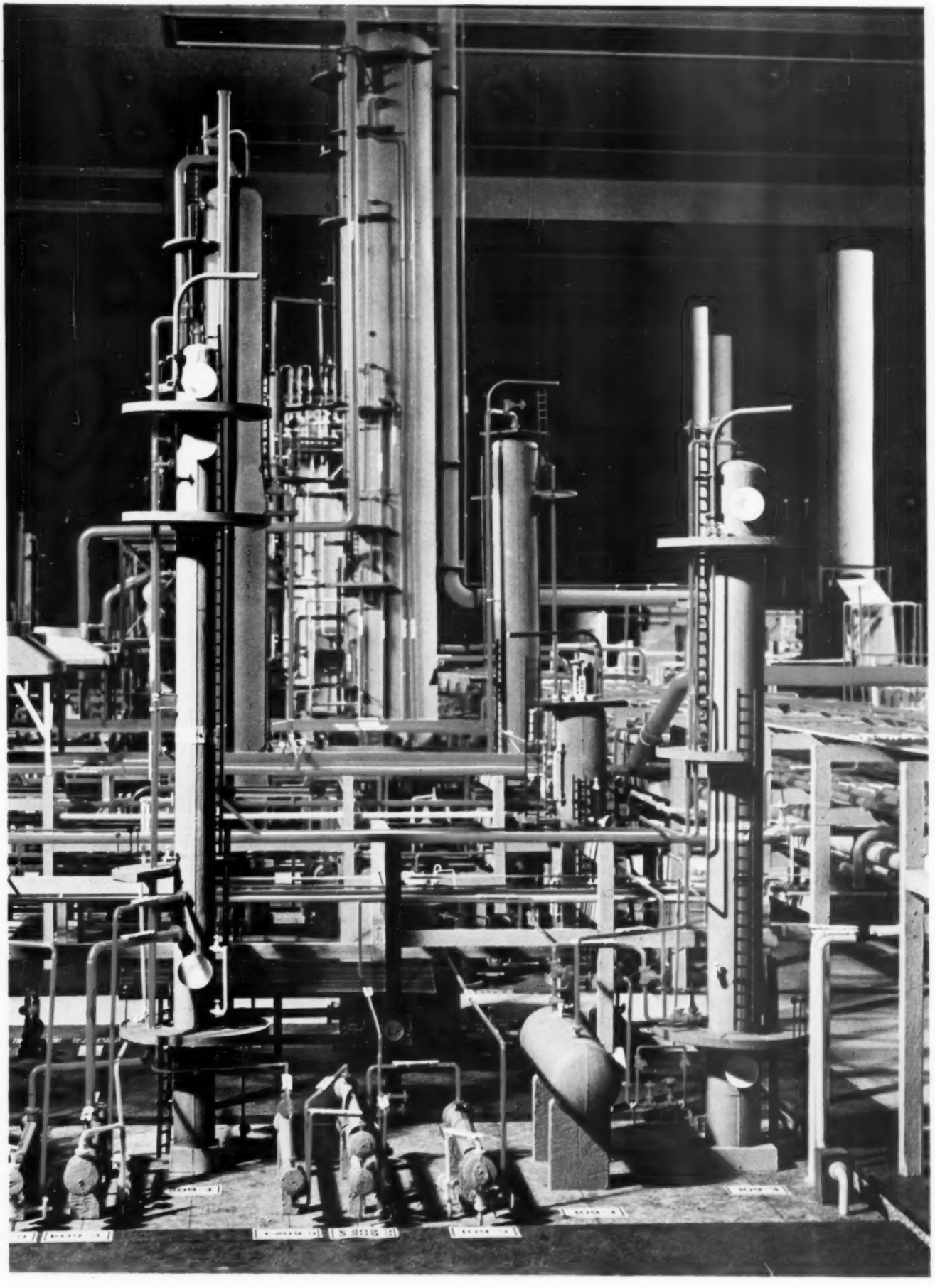
A shop was provided with machines adapted for fabrication of non-stock items. The model shop, which also serves as stockroom, supplies pieces such as pumps, exchangers, pressure vessels and other "standard" equipment from pre-formed stock modified as required. Special items such as compressors and furnaces were made from stocked bulk materials.

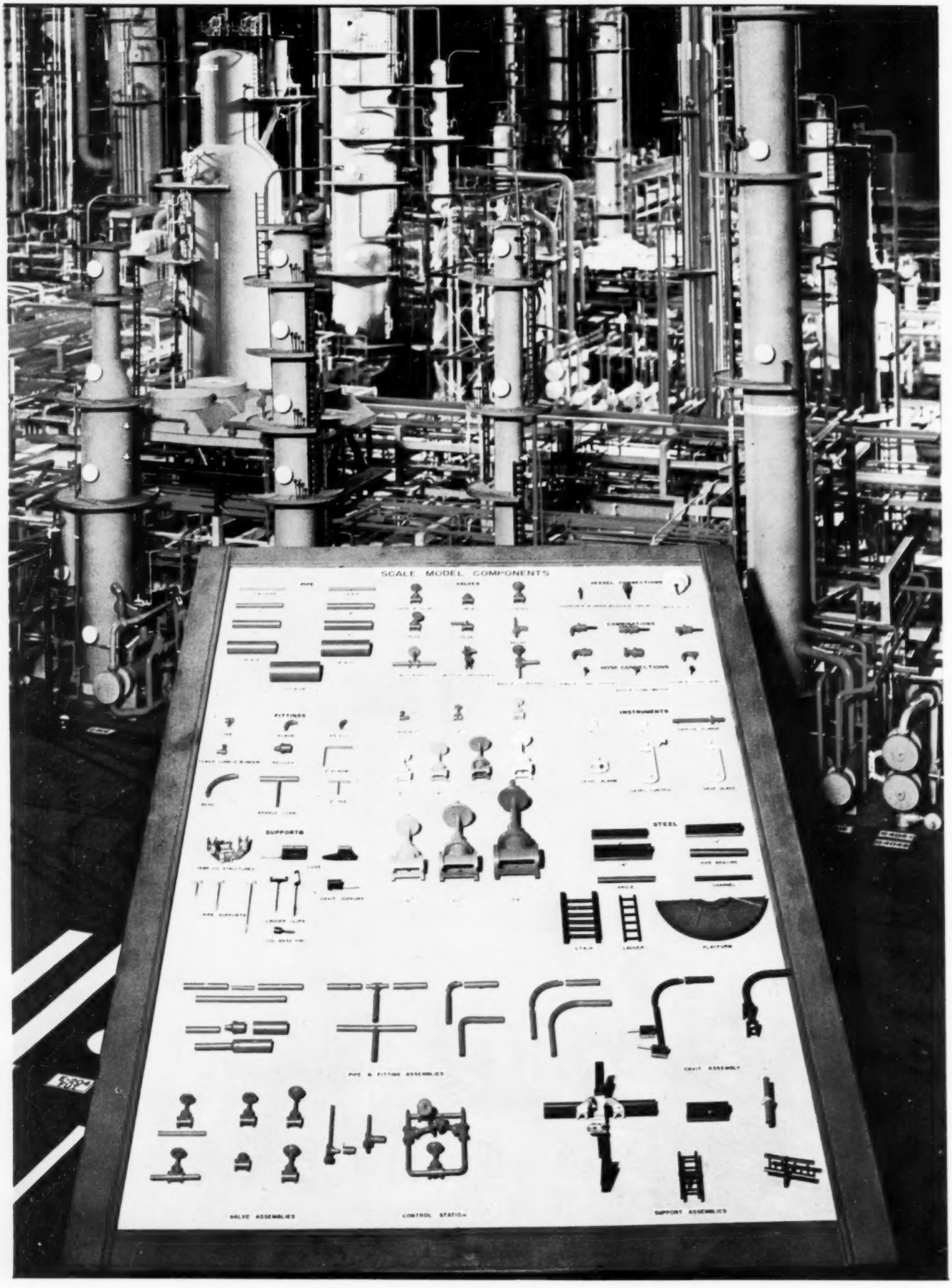
Assembly points were set up throughout the drafting room and equipped with supplies of color-coded pipe and replicas of valves and pipe fittings comprising more than 90 molded components. Special clips, gudeons, clamps and pins were provided for mounting ladders, nozzles, structures, pipe supports, etc. Special jigs were developed to speed assembly.

Assembly Requires No Tools or Adhesives: In assembly, a "push-fit" technique is used to secure pipe and pipe fittings to each other and to equipment. This simple and rapid assembly method requires no tools or adhesives. Modifications can be made readily and piping can be reworked easily. When final approvals have been obtained, model components can be cemented together for permanency.

The normal practice of subdividing a project into areas small enough for convenient handling and control is also followed when using the Kellogg model techniques. The designer who is responsible for the arrangement and detailed design within that area is also responsible for the model. At appropriate times these model areas

Section of model recently completed for a large Midwest oil company. The entire model, duplicating the complete refinery, represents a plant investment of more than $34 million.




SCALE MODEL COMPONENTS
PIPE
VALVES
VESSEL CONNECTIONS
COMBINATIONS
HOSE CONNECTIONS
FITTINGS
INSTRUMENTS
SUPPORTS
STEEL
STAIR
LADDER
PLATFORM
PIPE & FITTING ASSEMBLIES
DAVIT ASSEMBLY
VALVE ASSEMBLIES
CONTROL STATION
SUPPORT ASSEMBLIES

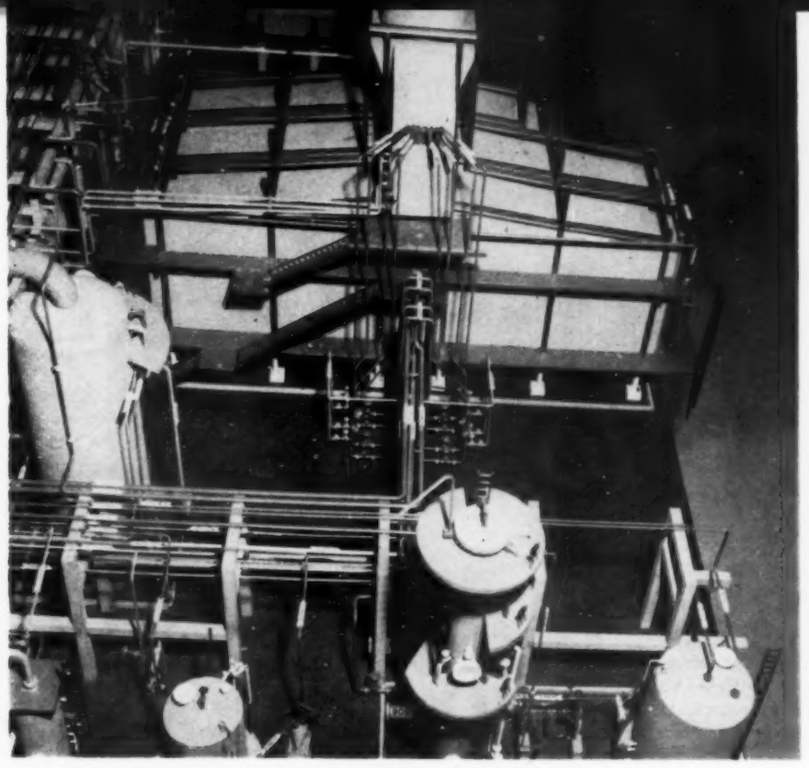


Fig. 4. Complete agreement between client and design representative was reached, without preliminary drawings, on layout of multiple furnace inlet. Client desired a completely balanced arrangement for equal pressure drop. New arrangement was set up on model and agreement reached in one meeting.

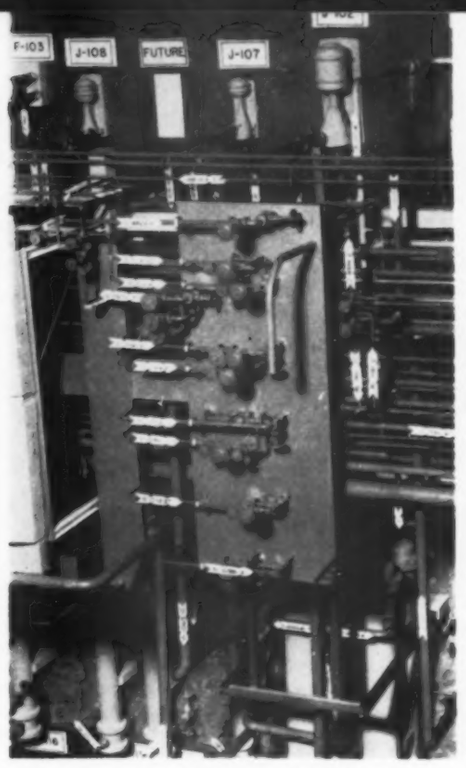


Fig. 5. Complicated blending station, difficult to visualize from design drawings, was readily understood from the model. After viewing arrangement on model, those responsible for process, operation, and maintenance agreed the planned arrangement of valves and instruments offered maximum convenience.

are brought together for overall appraisal and review.

Many models have been constructed in the past two years. One of the most recent and largest is a complete model refinery for a major oil company in the Midwest. The model, covering 510 square feet of floor space represented a refinery investment of over $34 million and showed all seven process sections and the steam generating plant.

The ease with which Kellogg models are assembled and revised has eliminated the need for specialized model craftsmen and has made it practical for Kellogg design personnel to work directly on the model. This not only enables the model to proceed concurrently with the engineering design, but also places the emphasis on plant design rather than model construction. This technique results in a single, progressively advancing model representative of the design at any point. Assembly is fast enough to keep pace with the most demanding schedules. There is no time lapse for changing types as with conventional changeovers from bent wire to solid tubing models. One model now takes the place of several previously used. Yet, neither the accuracy nor the realism of full scale components has been sacrificed. The model emerges as a fully-scaled, color-coded miniature of the projected plant.

How Models Improve Design: Rapid design engineering is a fundamental requirement of professional contract operations. The speed with which designs can be completed is often a factor in awarding a contract. Kellogg engineering groups are organized to quickly develop all phases of new plant planning. Once process has been established, the many design groups work simultaneously on their specialized phases of design—layout, vessels, piping, instrumentation, etc. The model, constructed as design proceeds, becomes a master plan incorporating all the physical arrangements of design.

As a master plan, the model offers the entire technical staff an added opportunity and medium for evaluating and improving their own contributions. It enables them to recognize and appraise the effects of their work on the design work of other groups. For an example, some of the obvious are:

Structural economies
Piping interferences
Plant lighting
Equipment handling facilities
Clearances
Conduit runs
Minimize piping runs
Access for operation such as valves and instruments
Access for maintenance
Proper support
Appraise calculations by direct observation

Through the greater correlation of design thinking which the model makes possible, designers can more quickly provide better solutions to design problems—solutions which result in a more satisfactory plant and improved plant operation.

Misunderstandings, differences of opinion and simple errors become clearly apparent when discussed at the model location. Whether the need for clarification exists between functional groups of the engineering organizations, among supervisory and design personnel, or between customer and contractor representatives, the unmistakable evidence of three-dimensional clarity clearly presents the physical aspects of a situation for judgment and decision.

How Kellogg's Technique is Applied: The scale model which can be rapidly constructed within the drafting room and easily altered to incorporate revisions, offers an ideal means for reaching agreement on the kind of plant the client requires. Preliminary design can be made on the model and revised as needed; final design details can be approved in model form enabling client approval to be secured on the model without drawings. The following examples, taken from modeled projects, illustrate the value of this procedure, and of the model in plant design.

Plot Arrangement: A change from water to air cooled heat exchangers created a serious space situation on this project, a complete refinery. The air cooled units required much more room and would have added considerably to piping costs. Kellogg proposed a novel solution which answered both problems economically. This was to locate the coolers *above* the yardbank. When this solution was shown on the scale model (Fig. 1) doubts as to its feasibility were removed and the arrangement was accepted by the client.

Equipment Handling: The model was chiefly responsible for a new arrangement of equipment and structures to achieve maximum use of the guyed derrick shown in Fig. 3. The derrick was originally intended to serve the 42 inch control valve in the center of the area. A study of the model showed that by rearranging the manholes and platforms of the huge vessels, the usefulness of the derrick as a maintenance tool could be extended. The big boom is now able to serve not only the massive valve and vessel internals, but more than 60 other heavy accessories

Principal modeled plastic units used in assembling components for the scale model of a refinery. Major units are formed from stocked materials on simple machinery in the model shop.

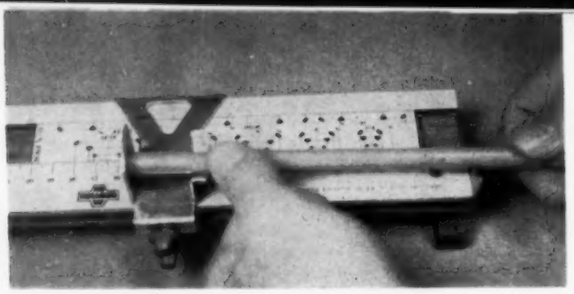


Fig. 6. Special jig developed for measuring straight lengths of piping or structurals simplifies operation and helps speed assembly.

Fig. 7. Pipe and elbows are designed for push-fit assembly. This method is simple, fast, and models can be readily revised when necessary.

which must be lowered to grade for maintenance.

Process Flow: The client's process control group desired that piping to the multiple furnace inlets be completely balanced to equalize pressure drop. To reach a thorough understanding between client and design representatives, a model of the area was made within two hours and a decision reached in a single short meeting. The elimination of preliminary design drawings and the subsequent discussions which would ordinarily have been required, offered a direct saving in money and time.

Plant Operation: The complicated valve and instrument arrangement shown in Fig. 5 was difficult to visualize from drawings alone. Only after reviewing the model were client engineers responsible for process, operation, and maintenance agreed the arrangement offered maximum convenience.

Plant Maintenance: Some installations require that major consideration be given to unit maintenance. Typical are units for the decoking process which, because of their cyclic nature require more than usual access for frequent piping maintenance. Getting the best possible arrangement is vital to the operation of the unit. The arrangement received careful scrutiny and several modifications for improved access were made before it was finally accepted by maintenance groups.

Periodic Model Review Saves Money: It is axiomatic in contract engineering work that indecision and changes become progressively more objectionable from the point of view of engineering cost and of job delay. A model of any type assists in obtaining design decisions, comments, changes and approvals. However, the integration of the Kellogg model technique into the design organization right from the preliminary planning stage through to the final design makes it possible through periodic reviews to secure and incorporate these decisions and comments with minimum cost and delay.

Advantages to Construction and Operation Departments: The Kellogg model technique, because of its rapid construction, enhances the advantages that both the contractor's and client's construction and operating forces derive from models in general. Having the model available sooner enables both groups to do planning at an earlier and more appropriate time.

The actual construction of a processing unit installation is preceded by a construction planning phase. During this period, before the project has left the engineering office, construction people are determining the most desirable schedule for the delivery of equipment, tools and other materials, the optimum location for guy derricks, gin poles, etc. and in general are planning the most efficient erection sequences and procedures.

The scale model is a much more effective medium for carrying out this planning than the time consuming task of assembling and studying the innumerable drawings involved. Furthermore, overall perspective or isometric drawings of the project are replaced by model photographs with savings in time and with improved rendition.

As the plant nears completion of construction the operating groups spearhead the effort which is being directed toward getting the plant "on stream". This is a critical period, and delays are particularly expensive. The smooth and rapid attainment of process performance predictions depends to a large degree upon the opportunity for thorough planning by the operating forces. Three areas where a scale model aids the operating department in this respect are as follows:

(1) A progressive review of the job during the design stage in order to insure that all operating requirements are met. In the past this operator's review usually occurred in the late stages of erection and consequently the necessary changes were not only expensive but delayed start-up.

(2) The preparation of operation instructions.

(3) The training of operating personnel.

The Economics of Model Design: In discussing the cost of a model it is important that we differentiate between a "design model" and a "replica model." A "design model" is one that is built specifically to aid and improve the design and therefore must be made concurrently with the design and be frequently changed and altered. A "replica model" is one made from completed designs. Naturally the cost of the latter will be far less than the former.

Kellogg uses two types of design models, the "complete design model" and the "planning design model". The "complete design model" is continued through the entire design period and ends up as exact scale reproduction of the contemplated plant. The "planning design model" is continued only through the planning phase.

The cost of building a model will vary depending upon the purpose. For a "complete design model" the cost will be approximately .4% of the erected cost of the plant. For a model that is carried through the planning phase only the cost will be cut in half.

On the other side of the ledger we find that the savings are rather difficult to calculate since many of the advantages are intangible. However, Kellogg's early experience with models showed savings in materials (pipe, valves and fittings) and field labor that essentially compensated for the cost of the model. In our more recent development, in which design and model making are integrated, there is a very definite indication of an appreciable saving in engineering costs. When these are added to reasonable credits for the many other advantages of models it is evident that models more than pay their own way.

Conclusions: In summary, the Kellogg model technique is the successful start of an overall attack on broad problems of engineering affecting, ultimately, all users of engineering services. The Kellogg technique (1) permits taking greater advantage of the general benefits of models; (2) provides a progressive, visual progress report on the status of design; (3) provides an improved communication channel through which responsible people can apply their experience far more effectively; (4) opens the way to more efficient process plants through improved methods of design. END

Fig. 9. Pumps and exchangers are assembled from molded stock parts. Method provides an inexpensive and accurate duplication of the real thing.

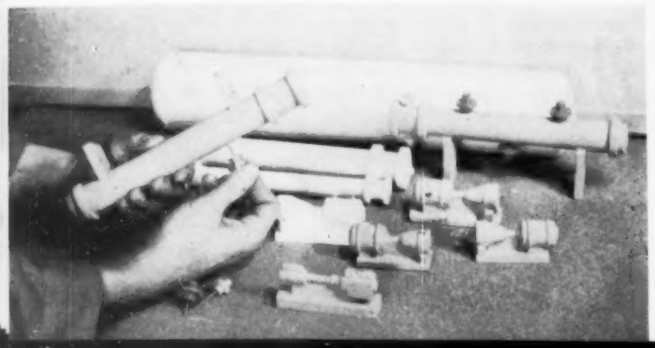
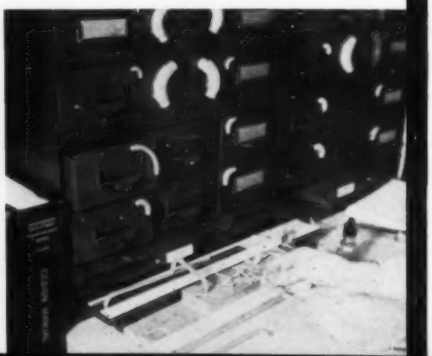


Fig. 8. Model valve snaps over piping and closely resembles appearance of field-assembled piping and valves. Valves are easily removed for design change.

Fig. 10. Working area showing bins for stock parts: Similar working areas are set up at strategic points in the drafting room.



The Royal Dutch-Shell group early entered the field of scientific research. This is a laboratory around 1912.

SHELL'S DIAMOND JUBILEE

1957 is a golden-wedding anniversary for Shell. It marks the 50th anniversary of the full amalgamation of Royal Dutch with Shell. They formed the far-flung Royal Dutch-Shell group of companies which operates worldwide today.

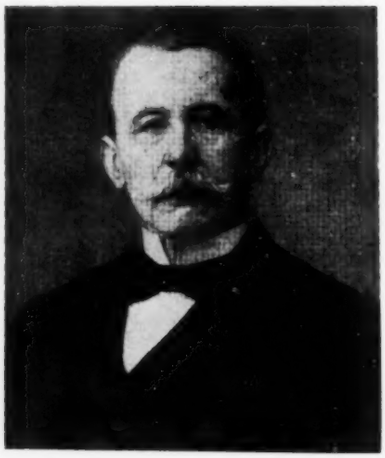
SHELL Transport & Trading Co. Ltd. was formed 60 years ago in London, on October 18, 1897. Its birth neary coincided with another historic event; two years earlier the first Horseless Carriage Exhibition was held in Tunbridge Wells, Kent. From 1896 the production of gasoline (or motor spirit or petrol, by whichever name it was known) paralleled the growth of the automobile industry and it may be said that The Shell Transport & Trading Co. Ltd. matured and grew up with the modern petroleum industry. Today Shell is confronted with its greatest opportunity and challenge but its prospects seem bright—the best, perhaps, of any major oil company today.

The Shell Transport and Trading Co. Ltd.: The Shell Transport and Trading Co. Ltd. (40%) and the Royal Dutch Co. (60%) are the parent of the Royal Dutch-Shell group of companies which number nearly 500 and, among them, cover every phase of the oil industry.

It was mentioned earlier that The Shell Transport & Trading Co. was formed in 1897. The chairman at that time was Marcus Samuel, who was knighted in 1898 and later was raised to the peerage, when he took the name of Viscount Bearsted. He died in 1927; so almost half of Shell's life to date was passed under his guidance. The company was originated in 1830, by Marcus Samuel, father of Viscount Bearsted, who started a trading concern to deal with products from the Orient. He exported manufactured products of all kinds for Europe and, in return, imported products from the East—which products included tea, jute, rice, and, among other things, various types of sea shells. These shells had a ready market in England and other European countries—both for ornamental purposes and also for the manufacture of buttons, knife handles, brooches, etc.

Marcus Samuel Sr. died in 1874. His two sons, Marcus (born 1853) and Samuel (born 1855), carried on the business. Later, competition in the firm's established trading interests became strong owing to the entry of Japanese traders, and the two brothers sought for a new product, not produced in Japan, which could be sold in the East. This new product was kerosine. At that time, the Standard Oil Co., controlled by John D. Rockefeller, was selling American kerosine in the Far East, and Nobel Bros. were selling kerosine produced in Russia. Marcus Samuel came to an arrangement with BNITO, a Russian group of companies controlled by the Rothchilds, for supplies of kerosine in cases from Batum. His next move was to build a tanker for the carriage of kerosine. This 5,000-ton vessel— christened "MUREX," after the name of a sea shell—was built by William Gray & Sons at West Harthpool and launched in 1892—making its initial voyage through the Suez Canal in the same year and carrying a cargo of Russian kerosine to the Far East. It was the first bulk-oil-carrying ship to be allowed to enter the canal.

Having established his markets for kerosine, Samuel then formed a "tank syndicate" to sell Shell kerosine for delivery into customers' own containers. Standard Oil Co., however, shipped kerosine in a tin container holding 5 American gallons—which, after being emptied of its contents, was put



Far left: Father of Shell was Marcus Samuel. Exotic sea shells, for the manufacture of jewelry, imported into Great Britain from the Far East in the early trading activities of M. Samuel & Co., later gave the infant oil company its name when kerosine was added to the firm's merchandise in 1890. Marcus Samuel was knighted in 1898 and raised to the peerage in 1925. Known as the First Viscount Bearsted, he was first chairman of Shell Transport & Trading Co. Ltd., formed in London in October of 1897.

Left: J. B. August Kessler, first managing director of Royal Dutch Petroleum Co., at The Hague, later amalgamated with Shell interests.

ROYAL DUTCH-SHELL GROUP

SALIENT OPERATING STATISTICS

	1956	1955	1954	1953	1952
Gross production of crude oil (1,000 b/d)	1,663	1,501	1,379	1,307	1,262
Quantities received under supply contracts (1,000 b/d)	411	418	372	352	344
Total (1,000 b/d)	2,074	1,919	1,751	1,664	1,606
Crude Oil processed (1,000 b/d)	2,076	1,964	1,837	1,690	1,631
Total tanker fleet owned and chartered:—(1)					
Tonnage (1,000 d. w. tons)	8,600	7,700	7,100	6,600	6,600
Number of vessels	552	505	488	487	520
Carrying capacity (T-2 tanker equivalent) (2)	527	469	420	385	371
Oil products sold (1,000 metric tons)	98,900	92,100	86,000	79,200	77,800
Chemical products sold (1,000 metric tons)	1,800	1,650	1,350	1,250	1,100
Natural and refinery gases sold (million cu. ft.)	343,400	320,800	309,100	240,800	190,900

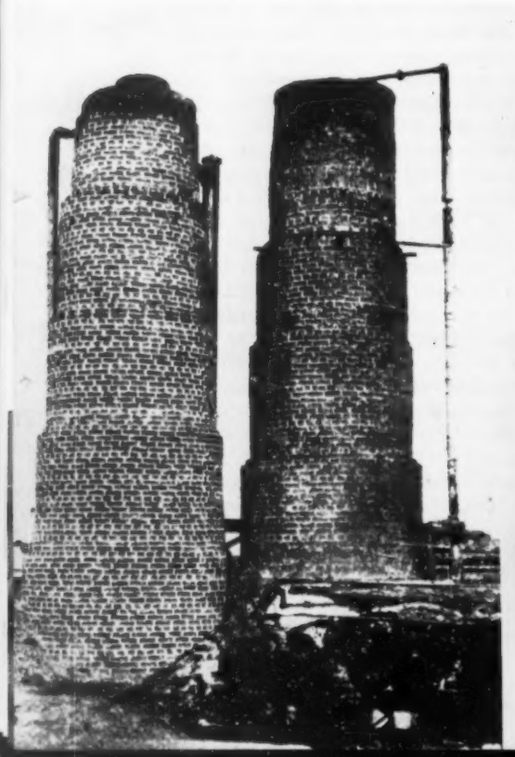
In this table 100% of the operations is included in the case of companies in which the Group holding is more than 50%, but only the percentage of such operations corresponding to its holding for companies owned 50% or less.

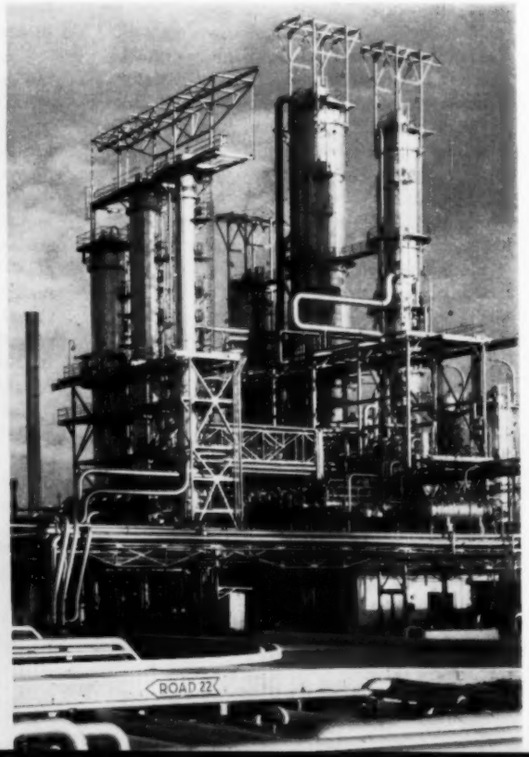
(1) Vessels of 2,000 tons d. w. and over.

(2) Calculated as vessels with a carrying capacity of 16,600 d. w. tons, and a speed of 14.5 knots.

Note: All statistical tables supplied by V. S. Swaminathan, London.

These two photos show the growth of refining in the Dutch-Shell organization. Towers for refinery operation, at the left, were designed by an American, Milon J. Trumble, who in 1913 built the plant for Shell of California. At right is the modern Stanlow refinery at Cheshire, England.





to many varied uses. Samuel, therefore, arranged to have similar tins made locally —which, being bright and free from rust, compared favorably with the tins arriving from the USA which had often been externally rusted during the voyage. What caused Samuel to take the next major step in his operations was the threat that the Russian government intended to insist on Russian oil being carried in Russians bottoms only—which would seriously have affected his shipping business. He, therefore, looked for other sources for kerosine, and found one in Borneo. He acquired oil concessions there in 1896, and built a refinery at Balik Papa.

The growing importance of this oil industry and the increasing demand by the automobile industry for gasoline was responsible for the next step: The brothers Samuel decided to form a new company to deal in oil—keeping this operation separate from the family trading business. This new company (to which was given the name Shell Transport & Trading Co. Ltd. and which, as mentioned previously, had been formed in 1897), after a commencement in 1889 with a kerosine contract followed by its first tanker in 1892, developed under Samuel's energetic leadership into one of the world's largest oil companies. It owned 30 ocean-going tankers, 31 ocean depots throughout the East and 11 more planned, 320 subsidiary depots in towns throughout the Orient, an oil field in Borneo, and a newly built refinery.

The demand for gasoline was increasing rapidly; but the Borneo oil, while being a satisfactory source of kerosine, had only a small gasoline content. To obtain further supplies of gasoline, Samuel contracted with a small field in Sumatra, viz., MOEARA ENIM, for supplies of crude which had the required gasoline content. Later, he made a contract in America for the supply of gasoline made from crude produced in the Spindletop field in Texas. Shell thus became the first oil company with worldwide sources of production.

Amalgamation with Royal Dutch: About the year 1899, gasoline made from Sumatra

The 38,000 dwt "Zaphon," flagship of Shell's tanker fleet, on her maiden voyage to the Persian Gulf.

Early horse-drawn tank wagon delivering Shell gasoline in California circa 1912.

crude oil was being marketed in the Far East by a Dutch company, with headquarters at The Hague. This company was managed by J. B. August Kessler, who had as his chief assistant Henri Deterding. The company was incorporated in 1890 as NV Koninklijke Nederlandsche Maatschappij tot Exploitatie van Petroleumbronnen in Nederlandsche Indie. The name was changed to Royal Dutch Petroleum Co. in 1949. Mr. Kessler died in 1890, and Deterding was appointed his successor. The company's interests were very similar to those of Shell, and both companies were subjected to competition from the Standard Oil Co.—with periods of unprofitable price cutting. Deterding, therefore, approached Samuel with regard to an amalgamation of their two interest to fight this competition—the outcome of this approach being the formation of the Asiatic Petroleum Co. Ltd. in 1903, with Samuel as chairman and Deterding as managing director, and the house of Rothschild as a third partner.

The function of this new company was to combine the distributing resources and sales organization of Shell Transport & Trading Co., with the Dutch company in the Far East, and also to act as selling agents throughout the world for East Indies production. This arrangement left Marcus Samuel free to market a large volume of petroleum products derived from other parts of the world, independently of the Dutch company. By 1907, gasoline had become a commodity much in demand; and, in order to cope with this demand, large quantities of oil had to be distilled. This increase in distillation resulted, in addition to gasoline, in much larger quantities of kerosine—particularly in the USA. A price-cutting war ensued.

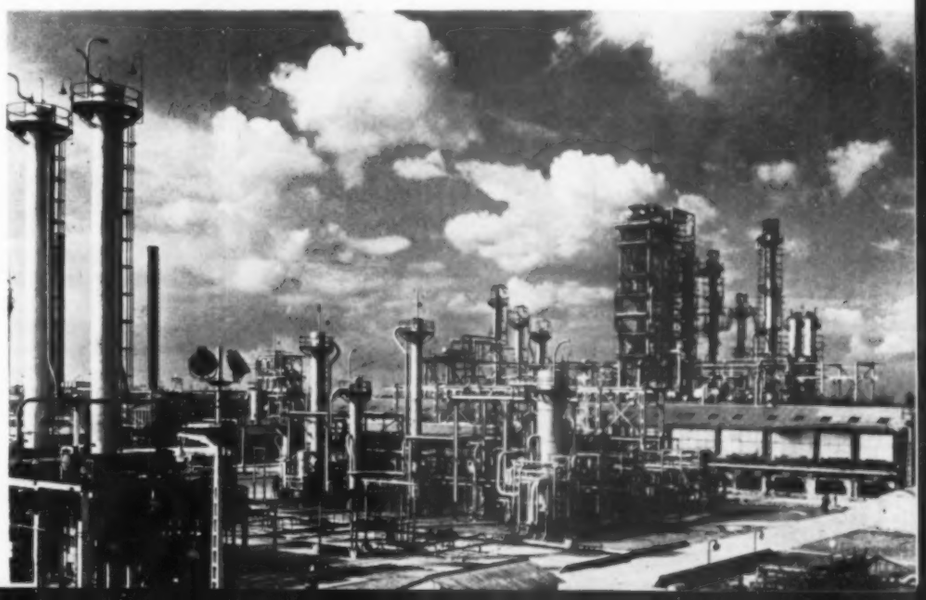
Incidentally, at this time, kerosine was sold in US 5-gallon tins in Mexico, at a price which only just covered the cost of the manufacture of the tins. Samuel, as an expedient to keep his largest tankers occupied, decided to ship kerosine from Romania to western Europe; but, owing to the price cutting was forced to sell on a falling market. The Dutch company, having a crude oil giving large percentages of gasoline, was able to take advantage of the rising market. It seemed advisable, therefore, that Shell and Royal Dutch should enter into a further amalgamation in order to fight this competition. So, in 1907, a further agreement was made between the companies, under which Royal Dutch and Shell Transport & Trading became purely holding companies—with interests in the proportion of 60% and 40%, respectively—which function they exercise today.

From this amalgamation has grown the present vast organization of the Royal Dutch and Shell group—which includes, among the others mentioned, NV de

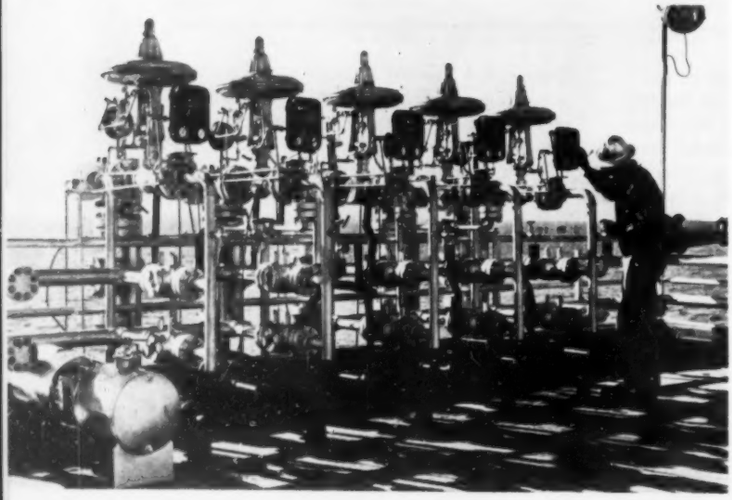
Shell Oil Company

Financial Highlights:—		
Revenue	$1,644,417,000	$1,498,489,000
Net income	135,848,000	125,532,000
Net income per share	$ 4.49	$ 4.14
Cash dividend paid per share	$ 2.00	$ 2.00
Cash income (net income plus write offs)	344,020,000	314,561,000
Net working capital at end of year	287,253,000	231,255,000
Cash and Government securities at end of year:		
Available for general purposes	120,691,000	96,014,000
For federal income taxes	52,800,000	63,500,000
Long-term debt at end of year	197,408,000	201,457,000
Capital expenditures	234,646,000	271,347,000
Operating Data:—		
Number of wells drilled	1,132	899
Net crude oil produced—barrels	111,317,000	101,581,000
Crude oil intake—barrels	182,184,000	168,896,000
Refined products sold—barrels	200,524,000	198,216,000
Chemical products sold—short tons	1,001,000	943,000
Number of employees at end of year	39,902	38,845
Salaries and wages paid	$ 253,966,000	$ 228,662,000

Shell's Stanlow refinery at Cheshire, England—now one of the largest integrated refineries in Europe. Covering 2,000 acres, operations are continuous 24 hours a day, seven days a week. (All photos in this article are by courtesy of Shell.)



First refinery on the US Gulf Coast, built to process oil from the famous Spindletop field in Texas, was erected in 1901 in a cow pasture near Port Arthur.



Progress in drilling techniques is illustrated by these two photos. At the top is Telaga Tunggal No. 1, Royal Dutch Petroleum Co.'s first productive oil well at Telaga Said, North Sumatra. First oil in commercial quantity was obtained in 1890, and in February 1892 the well yielded the raw material for the first refinery, at Pangkalan Brandan. Lower photo shows a modern marine drilling platform in the Gulf of Mexico handling five wells. It has been designed ultimately to accommodate 15 wells.

Night shot of a modern Shell service station in Germany.

Bataafsche Petroleum Maatschappij and the Shell Petroleum Co., Ltd. The ramifications of the Royal Dutch and Shell group of companies are so great that it is impossible to deal with them in a short article. An indication of this vastness is the figure for sales during the first half of 1957, which amounts to £1,307,449,000 (about $20 million per day). The crude oil processed during the same period totaled 393.3 million USA barrels. Some outstanding events in the history of Shell since its inception in 1897 follow:

1910: The first seagoing motor-driven tanker in the world, the M. V. "VULCANUS," was built to the order of Shell.

1913: Commencement of operation of the first "Trumble unit," which was designed by Milon J. Trumble in the USA. This unit can be classed as the forerunner of the present-day systems of petroleum distillation. The patent for this process was subsequently acquired by Shell.

1914-1918: In 1914, Shell built its first jetty on the Thames, at Shell Haven. In 1916 a small refinery was erected on an adjacent site—on which, and on another closely adjacent site, now stand Shell's modern Star Haven refineries.

During the World War I, there was a great shortage in the UK of aromatic hydrocarbons for the manufacture of high explosives, which threatened to considerably restrict the activities of the British Expeditionary Force. This shortage was considerably alleviated by Shell, which produced a highly aromatic fraction, in the boiling range of benzene and toluene, from its Far Eastern crude. This fraction was imported into the UK, where it was mononitrated in one of the ordnance factories. After this step, the fraction was distilled to separate the unreacted paraffins, and the mononitrates then further nitrated to the required extent to produce the high explosives.

1922: Research on the knocking of internal-combustion engines was carried out by Harry Ricardo, who was afterwards knighted. This led to the redesign of the cylinder head and the development of the first precise knock-rating test for automobile fuels.

In that year, also, Shell built a depot at Stanlow; and later on, in 1924, the birth of the present large Stanlow refinery took place.

1929: Organization of the Shell Chemical Corp. took place in the USA—which was formed for the purpose of manufacturing chemicals from petroleum, using processes originated by Shell Development Co. This company has been responsible for a vast new industry—manufacturing a wide range of petroleum and other products at its Houston, Martinez, Norco, Dominquez, Emeryville, and Wood River refineries.

1939-1945: These war years saw the results of two decades of intensive Shell researches and investigations which had many wartime applications. These ranged from high-grade high-octane-rating avia-

ROYAL DUTCH-SHELL GROUP

CAPITAL AND EXPLORATION EXPENDITURE (£-Million)

	TOTAL 1952/56	1956	1955	1954	1953	1952
Consolidated companies:—						
Exploration and oil rights	270	86	53	60	40	31
Production	451	102	94	80	86	89
Oil refineries and chemical plants	361	94	86	57	71	53
Marketing facilities	190	44	40	34	36	36
Ocean-going fleets	101	23	30	29	13	6
Miscellaneous	13	5	3	2	2	1
	1,386	354	306	262	248	216
Share of non-consolidated companies	122	34	27	24	19	18
Total	1,508	388	333	286	267	234

ROYAL DUTCH-SHELL GROUP

FINANCIAL STATISTICS (£1,000)

	1956	1955	1954	1953	1952
Gross income	2,321,470	2,051,866	1,852,046	1,700,714	1,616,616
Net income	179,528	159,992	134,474	130,413	125,605
Capital and exploration expenditure	354,000	306,000	262,000	248,000	216,000
Capital invested and earnings retained in the Group	1,248,734	1,108,289	980,686	871,500	767,580
Long-term debt	169,430	170,556	147,315	161,306	166,839
Net working capital	515,701	525,947	457,179	442,604	397,685
Cash and securities	320,110	344,121	346,081	315,076	261,698

Net income of the Royal Dutch-Shell group of companies for the second quarter of 1957 rose 36.7% to £58,776,000 compared with £43,311,000 for the same period of 1956. For the first six months of 1957 net income was £110,518,000 compared with £84,044,000 in 1956.

Expressed per share of the parent companies' issued capital, the foregoing figures are equivalent to:

	Second Quarter		Six Months	
	1957	1956	1957	1956
ROYAL DUTCH*	f6.17	f4.55	f11.60	f8.82
Equal to dollars ..	$1.62	$1.20	$3.05	$2.32

*Based on 60,818,280 shares of f20 outstanding at June 30, 1957.

"SHELL" TRANSPORT** converted to dollars	5s. 9d. $0.80	4s. 3d $0.59	10s. 10d. $1.51	8s 3d. $1.15

**Based on 81,772,043 shares of £1 outstanding at June 30, 1957.

tion fuels, explosives, etc., to synthetic rubber, soil fumigants, and insectides. During this period, also, the manufacture of "Teepol," Shell's synthetic detergent, was commenced in the United Kingdom, and helped to divert many natural oils and fats from soap manufacture to food manufacture. Incidentally, this was the first step taken in the development of the present-day large petrochemical industry in the United Kingdom.

1946: The Shell motor tanker "AVRICULA" was the first vessel to burn heavy fuel oil in a standard diesel engine—the method of carrying out this operation having been developed by Shell's research organization. The subsequent use of boiler fuel in diesel engines has fully proved the economy of this step; and it is probable that, at the present time, most motor vessels are using this type of fuel, rather than the lighter diesel oil.

1948: Shell's Thornton Research Center was formally opened. This research organization was inaugurated in 1941, and later was loaned to the government for the remainder of the war. After the war, new premises were erected, and much new equipment was installed.

1951: Europe's first modern catalytic cracking unit was installed at the Pernis (Rotterdam) refinery of the Royal Dutch-Shell group. This was followed shortly after by the commencement of operation of a similar type of plant at Stanlow.

In the same year, the first gas turbine to be employed in a merchant ship was installed in Shell's experimental tanker the "AURIS." This turbine replaced one of the four diesel-engine units which had originally been in the Auris, and worked in conjunction for another three or four years. At the present time, the AURIS is having her original diesel units and gas turbine removed. They are to be replaced by a new 5,500-hp gas turbine.

1952: The first major submarine oil-drilling operations in the British Commonwealth were started from a platform fixed on the seabed in the South China Sea, about a mile off the coast of North Borneo.

In the same year, the manufacturing rights of the outstanding "insecticides," ALDRIN and "DIELDRIN," were acquired by Shell, and a worldwide distribution commenced. The marked efficiency of these chemicals for pest control in general has already been fully proved.

1957: At the present time, in Europe, Shell has a refining capacity of some 713,000 b/d—which, with its large fleet and distribution facilities, finds employment for some 6,000 administration and clerical staff in London—at present dispersed among 26 offices located in different parts of London. Work has begun on a new office building on the south bank of the Thames, which comprises 26 stories and will accommodate the above staff. END

John H. Loudon, president of the Royal Dutch Petroleum Co. and board chairman for Shell Caribbean Petroleum Co., was recently elected chairman of Shell Oil Co.—succeeding Sir Francis Hopwood, who retired June 30.

Sir Henri Deterding, August Kessler's chief assistant, became managing director of Royal Dutch Petroleum Co. on Kessler's death in 1890.

F. J. Stephens was elected recently to fill the board vacancy resulting from the retirement of Sir Francis Hopwood from Shell Oil Co. Mr. Stephens is a managing director of the "Shell" Transport and Trading Co. Ltd., The Shell Petroleum Co. Ltd., and N. V. De Bataafsche Petroleum Mij.

"Workhorse" helicopter lifts a 4,115-lb slush pump by external sling. The pump is the heaviest component of a drilling rig entirely transportable by this Vertol model 44 helicopter. The entire 175,656 lb contained in a rig for drilling to 10,000 ft can be carried a distance of 50 miles, out and back, in 56 flying-hours. The twin rotors give the helicopter exceptional stability and lifting power (photo courtesy Vetrol Aircraft Corp., Morton, Pa.)

Helicopter service for remote oil-field operations

Entire drilling rigs have been carried to inaccessible jungle locations by helicopter. Use in reconnaissance work in swamp and jungle now is routine. Offshore use includes transportation of both crew and supplies

IN 1907, 50 years ago, two Frenchmen, Louis and Charles Breguet, made the first helicopter flight at Douai, France; but a good many years had to pass before this first flight, and the knowledge gained from it, could be put to commercial use.

The earliest use of helicopters in the petroleum industry was on the exploration side, where they served to act as carriers for aerial photographic units and transportation of personnel and equipment. By this means, men and material could be landed on sites, not usable by air or sea planes, and not readily accessible by other means. They have also been used in emergency operations, as urgently needed transport, in cases of sickness or accident, but are now becoming necessary versatile equipment with major uses in the petroleum industry. In their more recent applications, they are being used as definite transport necessities under certain working conditions.

Papua: Helicopters were first introduced into Papua in December 1953, where they were employed by Australian Petroleum Co. Pty Ltd., the shareholding partners in this company being British Petroleum Co. Ltd., Vacuum Oil Co. Pty., and Oil Search Ltd., the latter company representing Australian interests.

In these early days, the reason for employing helicopters was to speed up seismic surveys in territory covered by swamp and rain forest, on which there was no means of transport or communication, except on a few widely spaced rivers. Bell 47 helicopters were supplied on contract by Bahamas Helicopters Ltd. (which later became World Wide Air Services Ltd.), and were at that time the first helicopters to be used commercially on Australian territory.

When carrying out the seismic surveys, clearings were made in swamps and rain forests, of a minimum size of about 300 ft x 100 ft, at intervals of about a mile along the proposed seismic lines. The helicopters worked at a height of about 1,500 ft so that, in the event of power failure, they could autorotate to the nearest clearing. The average height of the surrounding jungle trees was about 80 ft.

When the helicopters had been introduced to replace ground work, output of the survey party was increased by about 2½ times, and there was a slight decrease in mileage cost.

Other advantages arising from their use were: More complete shorting could be undertaken owing to easier transport, and consequently the quality of the results was improved; long overland carrying of material by native labor was to a great extent eliminated which, in turn, resulted in a more contented labor force. By close coordination of the major river transport with the helicopter transport, the length of helicopter hauls was reduced—resulting in greater efficiency.

Helicopters were used on this type of work for over three years; during the latter part of this period, their use was extended to reflection surveys also.

Arising from the successful use of these helicopters in surveying, Australian Petroleum Co. decided to extend their employment in exploratory operations, by using them to transport drilling equipment to well sites; and recently a well has been spudded in, the whole of the equipment for which was transported by helicopter.

This well is located at Komewa in western Papua, about 50 miles from the coast, and some 8½ miles beyond the limit of navigation of the Awerra River. The building of a road over this 8½ miles of jungle-covered and swampy terrain would have been a very difficult and costly operation, and even under the best of climatic conditions in that country would have taken many months to complete; yet by the use of helicopters, in the matter of five weeks, the company landed, on site, a complete drilling outfit capable of drilling down to 10,000 ft, earth-moving equipment, building materials, and sufficient supplies to enable drilling to commence. Sikorsky S58 helicopters, the largest helicopters in commercial use at the present time, were used to carry out this project.

Three of these helicopters were used for the work, each of which can lift loads of approximately 4,000 lb, either internally or externally, with sufficient fuel to fly 100 miles, and seating accommodation for 13 passengers. For the shorter haul from the Awerra River, the load could be stepped up to 5,000 lb; loads of about 4,000 lb were normal when flying from the river to the well site.

In the main, the transport of material is a continuous process, several trips being made between river and well site without the helicopter making a landing. Equipment and supplies are assembled in cargo slings or nets in suitable loads at the landing end; the helicopter hovers over the load with lowered attachment device; the load is hooked on and flown to rig site where the opposite procedure takes place. In this way, turnaround is rapid and man-handling is

Americans and Australians in Papua use Sikorsky helicopters to transport drilling rigs and equipment to new well sites in the jungle (British Petroleum photo).

58,000-square-mile oil search in Nigeria includes aerial surveys by BP-Shell. This is one of the numerous drilling locations (Shell photo).

reduced to a minimum. One helicopter flew 33 tons of cargo to Komewa in 10½ hours' flying time.

Drilling is carried out by a National 50 rig which has been redesigned in such a way that all components can be dismantled into units of just under two tons.

At present, two rigs are drilling in Papua, with three helicopters serving them.

Nigeria: The first helicopter to be used in Nigeria, by the Shell-BP Development Co. of Nigeria, was a Hiller, which was first used in December 1954, but has now been withdrawn from service. This Hiller was later augmented by two larger type Westland machines, and since that time this fleet of three machines has had a monthly average of 10,000 miles flying, carrying 24,000 lb of freight and 500 passengers.

The machines are largely used for ferrying materials and men from Port Harcourt to oil locations in the Niger delta. The journey by rivercraft from Port Harcourt to the swamp terrain around Oloibiri can take up to 36 hours, but can be done in 30 min by helicopter.

Some two dozen helicopter landing sites have been constructed in eastern Nigeria since 1954—the farthest from the Owerri headquarters being at Kumba, where a geologist party is working. It is a flight of 200 miles, and is situated about 40 miles from the Cameroons' coastline.

At present two Whirlwind S. 55's are working on charter to the company; a third is due for delivery in the very near future; and a fourth of the same class is due to arrive in Nigeria towards the end of the year.

Recently, new landing sites have been established along the new pipeline route from Oloibiri to Port Harcourt, which is being laid down in connection with the production tests of the putative Oloibiri oil field.

Westland S. 55 heicopters are built by the Westland Co. at Yiovil, Somerset.

It has recently been announced by Shell-BP Petroleum Development Co. of Nigeria Ltd. that an oil-well drilling barge has been ordered for use in the tidal swamps along the Niger delta coast, with its first drilling location fixed in the New Calabar River estuary near Krukrama, in Degemar Division, approximately 20 miles south of Port Harcourt.

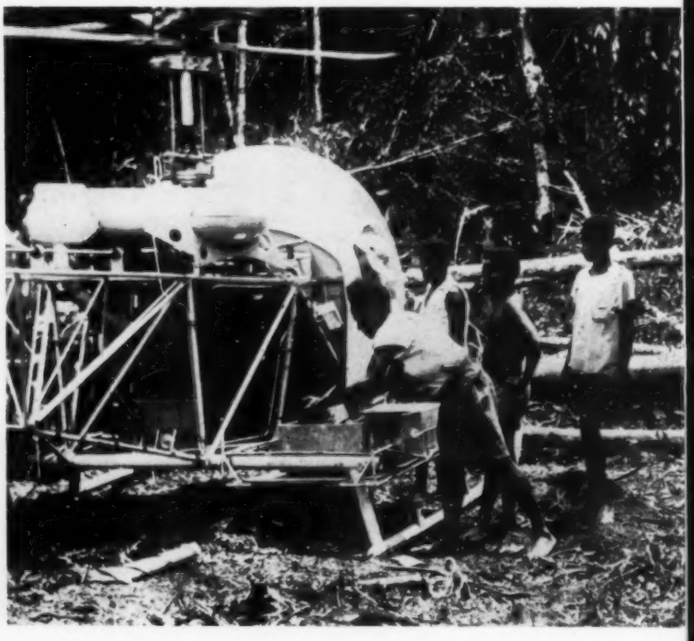
This drilling barge is to be jettied with a landing deck for helicopters, which will be used for the transport of materials and personnel between headquarters and the drilling location.

South China Sea: Two under-water drilling "steel islands" have been set up in the South China Sea, each "steel island" being equipped with helicopter landing platforms.

One "island' is located at Ampa Patches, a coral reef lying 30 ft below the surface, 25 miles from the coast of Brunei, British Borneo; a similar "island" is located some 60 miles southwest of Ampa Patches, and eight miles from the coast of Sarawak. Here the water is some 30 ft deep.

A helicopter lands on the specially constructed landing platform which projects from a side of the main structure of the 1,200-ton movable under-water steel drilling platform, five miles offshore in the Persian Gulf (Shell photo).

Oil search in western New Guinea: In a jungle landing ground—with rotors still turning—a Bell 47-D helicopter is being unloaded by native Papuans (Shell photo).



The "islands" are divided into two parts—one for the drilling operation, and the other for accommodating the crew. The roof of the crew's dwelling quarters acts as the helicopter landing platform.

The role of the helicopters on this location will be the carriage of fresh food, small freight, and personnel between the mainland and "island." A daily bus service is held for fresh food and other supplies.

Each drilling crew will spend eight days on the "island" and four days ashore. There are three crews, and at any time two will be stationed on the "island."

Persian Gulf: Helicopters were employed very successfully in connection with the under-water drilling carried out off Qatar by the Shell Co. of Qatar Ltd., until the mobile drilling platform was wrecked in a storm on the night of December 27-28, 1956.

Indeed, one of the helicopters on contract there remained on the platform until the last possible moment for the transport of personnel to safety.

As soon as a new drilling platform has been built and delivered to the Persian Gulf, the helicopter services will recommence.

It has been announced recently, by Shell Petroleum Co. Ltd., that N.V. de Bataafsche Petroleum Maatschappij of the Royal Dutch-Shell group has placed an order for a new mobile drilling platform, to replace the one wrecked off Qatar. This platform will be ready by the end of next year, when it will be towed out to the selected location on the Persian Gulf.

In the meantime, preparations are being made by Abu Dhabi Marine Areas Ltd., a company in which the British Petroleum Ltd. has a two-thirds share holding, and the Compagnie Française des Pétroles has one-third, to drill a deep test well some 20 miles off the island of Das. The island of Das has been developed as headquarters for the drilling operations in this area, which will be carried out from the drilling barge "Adma Enterprise," which was launched on April 11, 1957, at Audorf on the Kiel Canal.

This barge has airconditioned living quarters on board for the drilling crew and other personnel. Fifty men can be accommodated at any one time.

Its first location will be about 20 miles from the base camp on Das, and helicopters will be used for the transport of personnel, food supplies, and light freight. Heavy freight will be taken out by barge.

Two helicopters have been hired from Bristow Helicopters Ltd., who have been given a year's contract for their services, including pilots and maintenance staff.

Doha, Qatar: A.S. Bristow, of Bristow Helicopters Ltd., has given accounts of the operation of two Westland S. 55's in the Persian Gulf from the time they started their delivery flight from Eastleigh on September 20, 1955, in the *Journal of the Helicopter Assn. of Great Britain*, July 1956 and *Shell Aviation News*, December 1956.

The contract with the Shell Co. of Qatar Ltd. called for Bristow to provide experienced helicopter crews and management know-how to set up the operation and keep it going for at least two years—the helicopters, equipment, and base installation to be provided by Shell.

The task required was to carry drilling crews, Shell executives and technicians, minor drilling equipment, special tools, medical stores, mail and provisions from the Doha headquarters to the drilling rig, some 50 miles out to sea.

The flight deck on the drilling rig was built on a cantilever structure attached to one side, and measuring 50 ft x 70 ft overall. It was about 60 ft above sea level, and this position affected the landing on and takeoffs from the rig, as there was no ground cushion effect.

Unknown problems which required solution were: helicopter performance under conditions of high temperatures and humidity, maintenance problems connected with flying in a sand-laden atmosphere. Further, the service must be continuous, as it was being relied upon, almost 100%, to keep the rig working. A day's idleness on the rig involved loss of the order of £1,000 to the drilling company.

In order to guarantee these full services, certain precautions were necessary to avoid risk of breakdown; these included: prevention of corrosion to helicopters and spare parts; control of abrasion and damaging effects of sand; maintaining efficiency of carburetors at high ambient temperatures; methods to be employed to maintain highest possible payloads at these temperatures; and the practicability of overhauling major components on site.

Corrosion of helicopters was overcome by painting them with Naval Aircraft Protection Paint: Specification R.S. 116. Lanolin in white spirit was tried as a protective. This left a thin, clear, oily deposit which did not harden, and to which sand and dust adhered; and so this was not adopted.

Careful inspection of the tarnished parts was made regularly, and any deterioration or abrasion immediately remedied. Spare parts were wax-dipped if possible; or, if not, were treated with VPI powder and wrapped or sealed in polythene bags. The aircraft and blades were regularly washed with distilled water.

To overcome the damaging effects found during runup, takeoff, and landing, a sufficiently large space was covered with a 2-in.-thick layer of concrete, which was kept free from sand. Bearing surfaces which could collect sand on surplus grease were not cleaned off, but more clean grease was pumped in and excess grease containing any sand was thrown or blown off in flight.

For the maintenance of carburetor efficiency, the makers were asked to design and make an improved air-intake system which would reduce carburetion air temperatures at high ambient-temperature conditions and by that means prevent a loss of power. In addition, the removal of engine doors caused a drop in carburetor temperature.

The distance from the helicopter to the rig was a matter of some 50 miles, entirely over water; and, as a first safety precaution in case of power failure, the helicopters were jettied with floats. These, however, rendered machines difficult to handle on land. A trolley was designed to allow the aircraft to be turned through 360 deg, within the limits of the concrete landing site, in one movement—the aircraft to be rigged without movement for the trolley; and the float and wheel undercarriages to be interchanged easily and quickly without special ground equipment. This trolley was not intended for use on rough ground.

Radio communication played an important part in the safe and efficient running of the service. As mentioned, the route from the heliport and the drilling rig was over water for the entire 50 miles. Six and one half miles from the heliport, the track to the rig passes over a channel buoy, which is used as the first radio reporting point on the outbound route. Here the helicopter reports wind velocity, IAS magnetic course being flown, height, air temperature, and visibility. With this information, the radio-plot controller computes the course to steer for the rig and ETA at the rig, and passes this information to the helicopter. Thirteen and one-half miles from the base, the track passes within two miles of another channel buoy. This is the second outbound reporting point. The helicopter passes time and distance off, when abeam, together with any other relevant navigational information. The heliport controller checks ground speed and, if necessary, passes to the helicopter a new course to steer and a revised ETA at the rig. Twenty-two miles from the heliport, the route passes within three miles of another buoy, and again the helicopter position is reported and course altered, if necessary. This is the last navigation pinpoint, and the helicopter reports when rig is in sight. On clear days, the rig is visible from 1,000 ft when passing the first marker. The landing of the helicopter on the rig is reported to Shell's main radiotelephone and communications center. This has direct HF radiotelephone links with the rig and all Shell marine craft in the Persian Gulf area, and also has direct VHF communication between the heliport and the helicopters. At certain times of day, the radio communications center can work two-way VHF with the rig. The heliport control has its own VHF transmitter-receiver. The Doha telephone exchange is also wired to the Shell radio communications center—these connections giving very wide cover.

The average time of the flight between the heliport and rig is about 40 min to 45 min. The writer—on March 3, 1956—owing to weather conditions—had the unique experience of making the outward trip in 1 hour 15 min, and the return trip in 30 min. It would appear that the helicopter is a very useful addition to the tools which can be employed in the petroleum industry, and that its future usefulness will very probably be considerably extended. END

Biggest LeTourneau drilling barge launched

The world's largest drilling rig has been launched, while the builder, LeTourneau, predicts designs for drilling in 600 ft of water.

by James W. Calvert

ANOTHER three-legged LeTourneau mobile drilling barge has joined the growing fleet of behemoths operating off the Louisiana-Texas coast in the Gulf of Mexico, while engineers for R. G. LeTourneau Inc., of Longview, Texas, revealed plans for a giant which could operate in waters up to 600 ft in depth.

The newest rig to come out of the builder's riverside yard, in Vicksburg, Miss., is "Mister Cap," built for Barnwell Offshore Inc., of Shreveport, La., and described by R. S. "Sim" Barnwell Jr., president of the corporation, as the "Cadillac of the offshore drilling industry."

While patterned after the standard LeTourneau design of a self-elevating platform mounted on three lattice-work spuds, the "Mister Cap" is completely diesel-electric-powered and has many refinements and improvements not found in the first two LeTourneau rigs, the "Scorpion" and the "Vinegarroon."

"Mister Cap" has overall dimensions of 176 ft 2 in. in length and width; is 151 ft 9 in. in height; and will be capable of drilling in 85 ft of water during hurricane season, assuming a 15-ft penetration of the bottom and a 45-ft clearance between the bottom of the barge and the sea level.

Aside from the General Motors diesel-electric power plants which supply drilling and operating power for the mobile unit, the principal feature of the "Mister Cap" is the installation of a 50-ton stiff-leg derrick which is arranged to work over the well area and which can be used for setting production equipment, driving conductor pipe, and other duties to eliminate the need for an auxiliary derrick barge. Supplies and equipment are handled by two 25-ton electric whirley cranes located port and starboard.

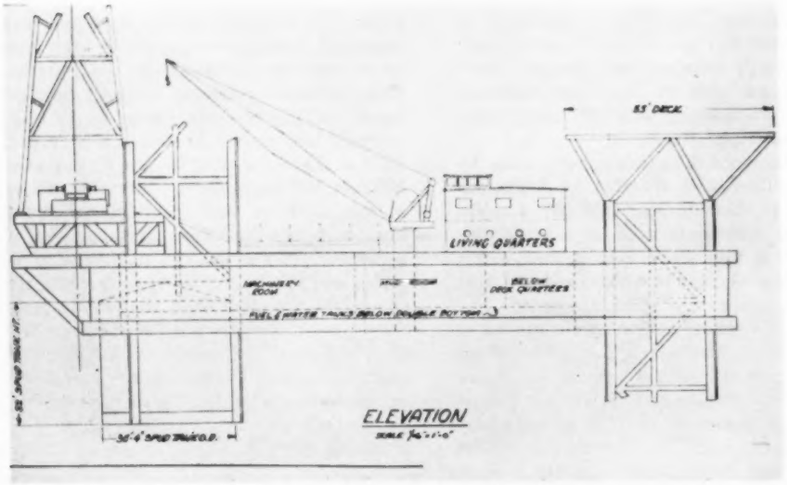
Power is derived from three General Motors (EMD) "Model 38 W8M" plants, each consisting of an 875-hp Model 567C diesel engine, and two 502-kw direct-current generators. They are mounted side by side, with an extended shaft driving a 400-kw alternating-current generator for ships service.

Drawworks arrangement consists of an electric-driven Ideco E-2500, with a capacity of 20,000 ft or more. The drum is grooved for a $\frac{3}{8}$-in. wire line, with a sandline capacity of 20,000 ft of $\frac{9}{16}$-in. line.

There are two EMSCO Model D1000 electric-driven mud pumps, each having two independently connected 625-hp direct-current motors and Model K 20 Hydril pulsation dampeners. There is also a 300-hp EMSCO mud-mixing pump with a 625-hp direct-current motor.

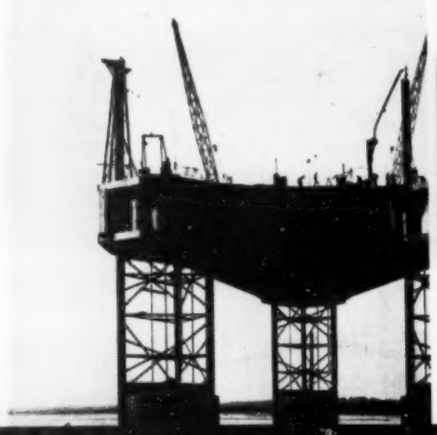
The Ideco 27½-in. rotary table is independently driven with another 625-hp DC motor. Other drilling equipment includes an Ideco 500-ton streamlined swivel, a 500-ton B.J. Model 5500 hook, vibrating-type Twin Thompson shale shaker, 140-ft galvanized "Super K" Lee C. Moore derrick, 480-ton Ideco "Big Shorty" traveling block with a 500-ton Ideco seven-sheeve crown, Salt Water Control Inc.'s Dorroco Size Six desander and its cascade vacuum-type degasser.

Like other LeTourneau rigs, which for the past two years have proved so practical in drilling off the Louisiana and Texas coasts, the "Mister Cap" has a supporting structure of tripod open-truss construction. The bottom of each spud is enclosed to form a pontoon which provides a substantial bearing area on the bottom of the ocean. Experience of predecessor rigs has proved that penetration will range from only a few feet in the hard sandy soil off the Texas coast to as much as 15 ft in the soft soil which characterizes the Louisiana under-water drilling areas. Often these

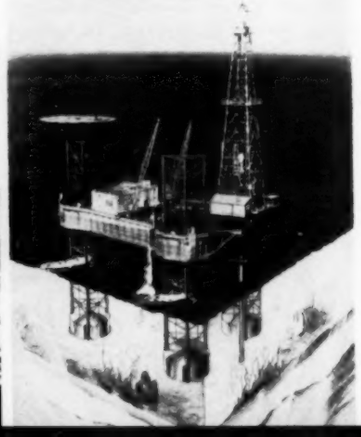


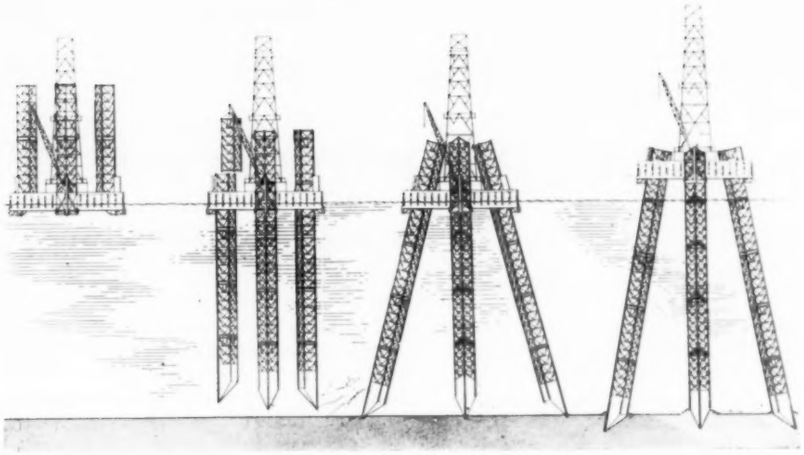
Side elevation view of "Mister Cap" shows the arrangement of machinery, storage facilities, and living quarters in the 176-ft hull of the barge. On location, the barge is raised to position 45 ft above the surface of the ocean and thence becomes a fixed drilling platform.

"Mister Cap," mobile deep-well platform under construction by Barnwell Offshore Inc.

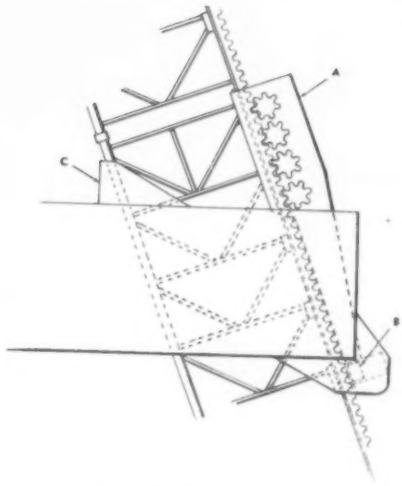


The "Vinegarroon," one of the first two of the LeTourneau rigs for drilling in 100-ft water depths—with cutaway to show how spud tanks afford controlled penetration.





Architect's drawing shows the four positions of the mobile platform proposed by R. G. LeTourneau Inc., of Longview, Texas, capable of drilling in waters up to 600 ft deep. At left the platform—in appearance similar to the conventional tripod structure designed by LeTourneau engineers—arrives at the drilling site and begins lowering its spuds. Additional sections of spuds are added by cranes aboard the platform. When within 8 ft to 12 ft from the ocean floor, the spuds are inclined to form the legs of a typical tripod—thus providing stability without the necessity of increasing the size of the drilling platform.



Barges are lifted, as is "Mister Cap," by a continuous engagement of spud rack and pinions; also barge guide and "hinge" arrangement of spud locomotives.

variations have ranged as much as three or more feet between spuds—thus proving a theory of LeTourneau engineers that three spuds, independently operated, can obtain a better drilling foundation than a structure of fixed uprights supporting a drilling platform.

The pontoons are built with a concave bottom for use in relatively soft soil.

"Mister Cap" is named for R. S. Barnwell Sr., chairman of the board of Barnwell Offshore Inc., a veteran oil prospector who is known throughout the petroleum industry as "Cap" Barnwell. Other officials of the company, also well-known in the industry, are Frank H. Harrell, executive vice president; Otis Solomon, general superintendent; and B. J. Robbins, chief engineer, who is also manager of the New Orleans office of the firm.

The LeTourneau design offers maximum stability, both afloat and in the drilling position. This platform is basically a barge which, afloat, has its three spuds in a retracted position with the pontoons drawn up into the spud wells of the barge. In this condition, the structure is towed to a drilling location at sea. In the event of heavy seas, the spuds can be lowered to react like the keel of a vessel—thus providing greater floatation stability.

Once on location, the spuds are lowered to the floor of the ocean, and the spud lengths are adjusted to provide maximum support. With a firm foundation assured, the drilling crew then elevates the barge to desired height above the surface of the water, and the barge then becomes a drilling platform. This is achieved by means of pinions and gears on the track of each spud. Pinions are driven by electric motors through gear reductions and, by this means, the platform can raise or lower itself at the rate of about 12 in. per min.

Most of the machinery is contained in the hull of the barge. This also includes storage facilities for drilling water, fuel, bulk mud, and cement. The superstructure on the opposite end of the barge from the derrick and drilling floor contains offices, dining room and recreational facilities, and airconditioned living quarters.

One of the three spuds supports a helicopter landing, since the "whirley bird" has become the conventional means of transporting personnel to and from the offshore drilling rigs in the Gulf of Mexico.

As prospecting for oil and gas moves farther out to sea, engineers have been pouring over the drafting tables to create structures which will operate in deeper water, and the LeTourneau engineering staff has been no exception. Indeed, vice president R. L. LeTourneau announced at a September meeting of the American Society of Mechanical Engineers, in Tulsa, the plans for construction of a mobile unit which could operate in waters out to the continental shelf—600 ft.

In a paper delivered before the ASME Petroleum Mechanical Engineering Conference, LeTourneau declared it would be possible to achieve stability without increasing the size of the drilling platform simply by spreading out the spud footings.

In principle, the deep-water unit proposed by the LeTourneau engineers would be similar to the conventional tripod design. The barge would carry additional sections of spud which could be added with the platform cranes while the spuds were in a vertical position. Lowering of the spuds vertically would continue until they were about 8 ft to 12 ft off the ocean floor; then the spuds would be set at a predetermined angle and lowered to the bottom.

The platform itself would be elevated by "spud locomotives," so hinged that the barge could climb its inclined stairway on all spuds at once, or independently if it is found necessary to adjust the length of the individual spuds to maintain stability.

When the barge arrives at its desired height above water, it would be preloaded to its maximum weight and locked into position. There its own heavy-duty crane could unload drilling equipment and supplies, and it would be ready to drill single or multiple wells.

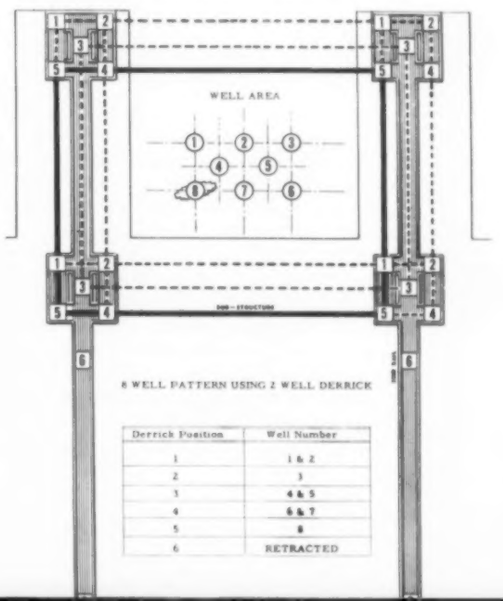
LeTourneau pointed out that, while the mobile drilling unit has proved a "must" for wildcatting, it could also be left as a permanent structure for multiple drilling if adequate production demanded it. To convert a mobile into a fixed platform to be left permanently on the site, the spud locomotives, elevating motors, and other specialized equipment could be removed and put into service with another platform—thus saving up to one-third the original investment.

"Self-elevated mobile platforms as a base for well-drilling operations in deep water are practical," he said. "Their economical conversion to fixed platforms for multiple wells will contribute in large measure to reduce oil-production costs offshore."

He said the proposed deep-water platform unit, capable of drilling 10,000-ft wells, in depths of water from 150 ft to 300 ft, probably would cost $11,000 per foot of water depth. A unit built for 20,000-ft wells in the same water depths would cost perhaps half again as much.

"Our hats should be off to some of the earliest open-water drilling contractors active in the Gulf of Mexico," LeTourneau added, "for these pioneer contractors assumed a large proportion of the obsolescence risk. I have suggested that obsolescence can be minimized with a self-elevating mobile platform so designed that it can serve also as a fixed platform." END

This two-well derrick permits from one to eight positions for multiple-hole operations.



Derrick Position	Well Number
1	1 & 2
2	3
3	4 & 5
4	6 & 7
5	8
6	RETRACTED

Review of recent USA patents on petrochemicals

by Heinz Heinemann and Harold Shalit

THE last Patent Review published treated olefins, their preparation, separation and reactions. One olefin reaction which was specifically excluded from the previous review was that of polymerization. This important reaction is the subject of the present article which is restricted entirely to the polymerization of olefinic hydrocarbons.

The great increase in production of polyethylene, polyisobutylene, polybutadiene, and other hydrocarbon polymers is reflected in a correspondingly large number of patents devoted to polymerization. This Review discusses some sixty-one selected patents, a number which does not represent the total issued on this subject. The patents have been selected because of their potential interest to the petroleum industry.

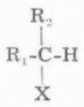
The patents reviewed here have been divided into six categories as follows:

(1) Polymerization of Eethylene and Propylene
(2) Polymerization of Isobutylene
(3) Diolefin Polymerization
(4) Polymerization of Cracked Hydrocarbon Fractions
(5) Polymerization Catalyst and Methods
(6) Miscellaneous Polymerization Patents

Polymerization of Ethylene and Propylene: E. Field and M. Feller (2,731,452 to Standard Oil of Indiana) propose the polymerization of ethylene and propylene to polymers of molecular weights above 300 by contacting these olefins with a hydride of beryllium, magnesium, calcium, strontium, or barium. There must also be present during the polymerization an oxide of a Group 6a metal; this combined catalyst may be supported on a difficulty reducible oxide. The conditions for the reaction are temperatures from 75°-325°C and pressures from 200-5000 psig. In 2,731,453, these same inventors claim the polymerization of gaseous olefins using a catalyst comprising an alkali metal aluminum hydride and an oxide of a metal from Group 6a all supported on a refractory oxide. The conditions here are temperatures from 130°C-325°C and pressures from 200-5000 psig. In 2,767,160, Feller and Field patented a polymerization catalyst consisting of an alkaline earth hyride and a composition of a minor amount of nickel or nickel oxide on active carbon. This catalyst is used at temperatures from 20°C-250°C. Another polymerization catalyst and process is proposed by Feller and Field in 2,773,053. This consists in contacting ethylene at 75°-325°C with an alkaline earth metal and a catalyst prepared from a Group 5a metal pentoxide. The pentoxide is supported on a refractory oxide. and is treated with a reducing gas at 350-850°C to produce a lower valent Group 5a oxide.

A patent (2,781,410) concerned with the new low pressure Ziegler process was issued to K. Ziegler, G. Wilke, E. Holzkamp and assigned to K. Ziegler. The patent claims an improvement in the polymerization of ethylene using as catalysts trialkyl aluminum. The improvement comprises using a metal selected from nickel, cobalt, or platinum as an activator.

Several patents deal with the conventional, high pressure ethylene polymerization process. D. C. Pease and M. J. Roedel (2,762,791 to the E. I. du Pont Co.) polymerize ethylene in the liquid phase by cooling the ethylene below 9.6°C and applying enough pressure to liquefy the olefin. The polymerization is catalyzed by free radicals obtained from azo compounds, metal alkyls, or peroxygen compounds which decompose to free radicals below 9.6°C. In 2,765,297 (R. G. Heiligmann and P. B. Stickney to the Borden Co.) a promoted catalyst is claimed for ethylene polymerization at pressures above 1000 psig. The catalyst contains two components: (1) an agent chosen from the group of organic peroxides or tetraethyl lead and (2) a substituted methane of the general formula



where X is $-CN, COOH, COOR_3$, $OOCR_3$ or $-O-C-R_3$ and R_1 is a C_1-C_2 alkyl group, R_3 is an alkyl group of less than seven carbons, R_2 is R_1 or X. W. R. Richard, Jr. of Monsanto Chemical Co. (2,777,833) proposes an improvement in the high pressure polymerization which consists in subjecting 55-95 parts of ethylene and 45-5 parts of 1-chloro, 1-fluoroethylene to copolymerization. The copolymerization is carried out in the presence of more than 10 parts by weight of water at 35°-125°C and pressures greater than 5000 psig, a further proviso being that the pressure should be greater than 20,000 psig when the concentration of the chlorofluoroethylene exceeds 25 parts.

Polymerization of Isobutylene: A most important polymerizable olefin is isobutylene. Its polymers and copolymers have attained a special importance because of their outstanding rubbery characteristics. The following group of patents treats the polymerization of isobutylene.

L. M. Welch, H. L. Wilson, and L. B. Turner (2,729,626 of the Esso Research and Engineering Co.) propose to improve isobutylene-diolefin copolymers by incorporating into the polymerizing mixture a divinyl aromatic hydrocarbon in amounts from 1-4% based on isobutylene. A diluent comprising an alkyl halide of 1 to 2 carbons is also used. In the low temperature, $AlCl_3$ catalyzed copolymerization of isobutylene and styrene, R. F. Leary (2,730,519 to Esso Research and Engineering Co.) claims that continuously agitating the mixture while maintaining a constant concentration of 47-40% isobutylene and 53-60% styrene and a constant conversion of 40-80% produces clear copolymers.

W. C. Smith and R. M. Thomas of Esso Research and Engineering Co. (2,734,047) disclose SbF_5 as a catalyst for the polymerization of isobutylene in an inert, non-complexing solvent.

According to J. L. Ernst and R. M. Thomas also of Esso Research (in 2,739,141) highly unsaturated copolymers of isobutylene can be made by mixing 100 parts by weight of isobutylene with 25-150 parts of 99 mole percent isoprene and cooling to from 0° to −164°C. The mixture is then polymerized with a solution of $AlCl_3$ in methylchloride to give a rubber of molecular weight between 20,000-100,000 and an Iodine Number from 55-175. In 2,739,143 (H. G. Goering and V. F. Mistretta of Esso Research and Engineering) the polymerization is carried out in hexane solution at −40°F. The catalyst is a slurry of 5% $AlCl_3$ in hexane, which slurry has been prepared at temperatures below −10°F. J. L. Ernst and H. J. Rose (2,772,255 to Esso Research) claim a process for copolymerization of isobutylene with diolefins. Polymerization is effected in hydrocarbon solution using monomer concentrations of 60-90 weight percent; temperatures are below −50°C and Friedel-Crafts catalysts or complexes thereof are used. Esso Research patent 2,775,577 (H. G. Schneider and P. W. Brakeley) control the molecular weight of polyisobutylene within the limits 10,000-20,000. This is accomplished by fractionating the butene charge to remove sufficient butene-2 so that the ratio of isobutylene to normal olefins is not less than 1:1 and the butene-2 is not more than 20 volume percent of the total normal butene content. Such a mixture is then polymerized at temperatures below 0°C with a metal halide catalyst. In 2,779,753 (A. R. Garabrant, H. G. Schneider, H. G. Goering, and H. O. Mottern to Esso Research) an improved polyisobutylene is made by polymerization at −58° to +104°F with non-complexed $AlCl_3$ of a particle size of less than 0.2 mm and in the presence of 25-95% of a C_5-C_8 alkane.

F. W. Banes and J. D. Garber (2,749,330 to Esso Research) claim a hydrolyzed copolymer of 62-85% acrylonitrile and 38-15% of an iso-olefin. The hydrolyzed product contains between 5-80% of the theoretical amount of carboxyl groups. In 2,753,328 (W. S. Barnhart to M. W. Kellogg Co.) isobutylene is copolymerized in equimolar mixture with trifluorocholoroethyl-

ene. The polymerization is carried out with 50 parts of water and 0.1 parts of potassium persulfate at 50°C for sixty hours.

Diolefin Polymerization: Another important class of polymerizable unsaturated compounds are the conjugated diolefins. This section is devoted to patents dealing with diolefin polymerization and polymers.

R. F. Leary, S. E. Jaros, A. H. Gleasor (2,712,562 to Esso Research and Engineering Co.) patent a method for producing liquid polybutadiene. They agitate a constant volume mixture comprising a stable dispersion of alkali metal in a hydrocarbon containing butadiene and polybutadiene at temperatures from 50°-100°C. Butadiene, solvent, and catalyst are introduced while an equal volume of reaction mixture is withdrawn. Another polymerization method patented in 2,719,142 (C. P. van Dijk and F. J. F. van der Plas to Shell Development Co.) comprises reaction at temperatures below 95°C in a two phase system. The continuous phase consists of an emulsifier in water, while the diolefin is the discontinuous phase. C. R. Greene of Standard Oil Co. (Indiana) in 2,762,790 polymerizes conjugated diolefins, in a hydrocarbon medium with an alkaline earth hydride catalyst. The hydride is used in conjunction with an oxide of Group 6a.

Conjugated polyenes are dimerized according to D. R. Carley and W. E. Foster (2,773,092 to the Ethyl Corp.). They add the polyene to a medium containing finely dispersed alkali metal of a particle size below 50 microns, between 0.001 and 10 weight percent of a diaryl ketone, and at least 300% of a solvent selected from ethers, acetals, or tertiary amines, all percentages based on the metal. The polyene is present in amounts not greater than 1 mole per mole of metal. C. K. Ikeda (2,777,890 to the E. I. du Pont Co.) prepares oily polybutadienes in the presence of BF_3 etherate at temperatures from −20° to +20°C. The etherate should contain 0.1-1.4 moles of water per mole of etherate. The viscosity of the polymer is then increased by treating its solution with BF_3.

In order to remove diolefins from gasoline fractions containing other unsaturates, N. Alpert and H. E. Vermillion (2,751,331 to the Texas Co.) propose to polymerize the diolefins selectively. This is accomplished by contacting the mixture with a halogenated carboxylic acid of 2-4 carbon atoms and containing at least two halogen atoms. Temperatures are maintained between 50°-200°F and the acid is present in concentrations from 0.5-10 weight percent.

In 2,787,609 (B. Bennett to The Secretary of the Army) a process is suggested for copolymerizing diolefins with copolymerizable compounds. The process comprises reacting the monomers in aqueous emulsion at temperatures above 90°C and in the presence of a phenyl alkyl selenol. The selenol should have at least two but not more than sixteen carbon atoms in the alkyl group. Synthetic rubbery materials are made according to G. R. Mitchell and N. H. Sherwood (2,744,099 to B. F. Goodrich Co.)

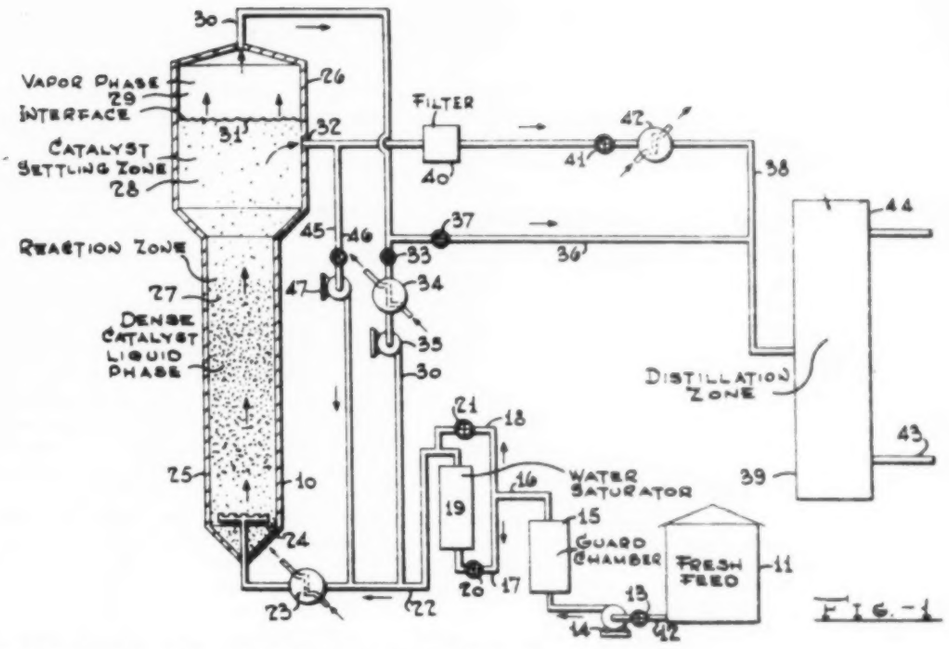


FIG. 1

Olefin Polymerization Process: USA Patent 2,755,324 to R. H. Mueller, July 17, 1956.

by copolymerizing a mixture of 89 weight percent butadiene, 10 weight percent of an alkyl acrylate with 4-8 carbons, and 1 percent styrene. The polymerization takes place in aqueous emulsion at 40°-50°F and is carried out to 60% conversion.

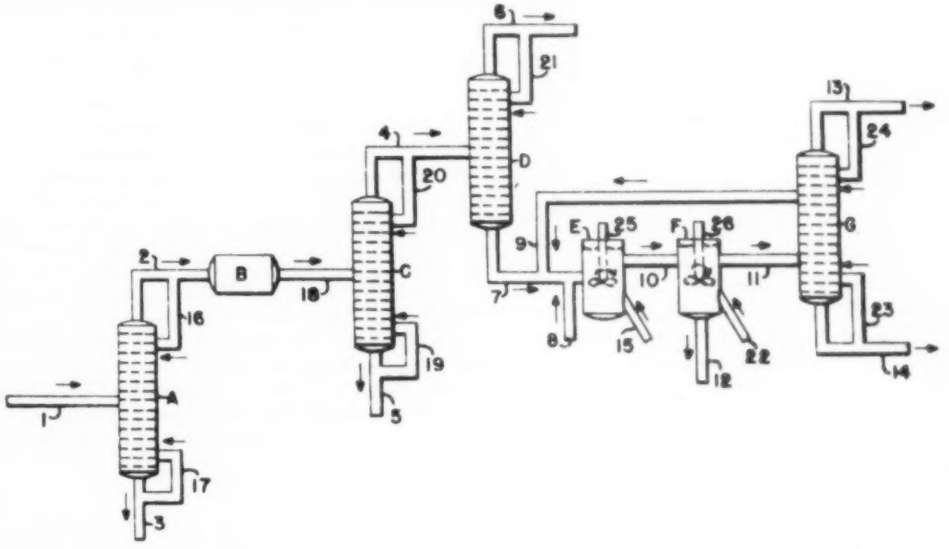
C. S. Lynch of the Phillips Petroleum Co. (2,770,603) catalytically reacts a polydiolefin latex with SO_2 to give a heteropolymeric resin product. In another Phillips Petroleum Co. patent (2,714,605 by R. V. Jones) a hydroxylated polybutadiene is sulfated by reaction with SO_3 in the presence of a teritary amine solvent.

Polymerization of Cracked Hydrocarbon Fractions: A whole series of patents was issued treating the polymerization of unsaturated petroleum fractions obtained by thermal or catalytic racking. This group of patents is discussed in the following section.

F. T. Wadworth (2,709,695 to the Pan American Refining Corp.) prepares liquid unsaturated hydrocarbons by pyrolysis of gaseous hydrocarbons at 1300-1550°F for 0.2-5 seconds. The liquid unsaturates are polymerized with more than 0.5% BF_3, at temperatures above 500°F, and in the absence of oxygenated compounds. Wadworth proposes a similar polymerization in 2,712,-538, this patent being directed specifically to a diolefin-free fraction containing C_7 and heavier hydrocarbons.

In 2,734,046, J. F. Nelson, R. F. Leary and F. W. Banes of Esso Research and Engineering Co. process a steam cracked fraction boiling from 20°-140°C by first heating it to dimerize the cyclodienes. The bulk of the material is separated from the dimers by fractionation and then polymerized in the presence of aluminum halide at −40°C to +70°C. S. B. Mirviss and F. W. Banes (2,750,353 to Esso Research) claim to improve the quality and yield of resins from olefin-diolefin containing stocks. This is accomplished by treatment of a solution of the polymerized material with 5-20 weight percent of a fraction containing C_5-C_6 diolefins and cyclic diolefins. Such treatment should be done before quenching of the polymerizate and removal of the catalyst. In 2,750,359, G. P. Hamner and T. G. Jones of Esso Research fractionate a steam

Polymers from Pipervylene Concentrates: USA Patent 2,753,382 to G. P. Hamner, July 3, 1956.



cracked naphtha to give a C_5 fraction boiling from 50°-120°F. Cyclodienes therein are dimerized by thermal soaking and the dimers separated by distillation. The undimerized portion is then blended with 5-15% of methylcyclopentadiene and polymerized at 0-80°F with BF_3. A steam cracked fraction boiling from 100-300°F is used by C. B. Moore in 2,750,360 (to Esso Research). This material is mixed with 5-20% methylcyclopentadiene and polymerized with BF_3 at −40° to +50°F. F. W. Banes, J. F. Nelson, and S. B. Mirviss (2,753,325 to Esso Research) claim to prepare soluble hydrocarbon resins from a C_5 fraction of a steam cracked naphtha. This fraction should contain from 15-60 volume percent piperylene and 35-70 volume percent olefins. The material is soaked at 37°-122°C to dimerize cyclodienes; the fraction boiling between 30-60,C is separated and polymerized in the presence of aluminum halides to produce the resins. In 2,753,326 (G. P. Hamner to Esso Research) a thermal naphtha boiling from 80° to 280°F is soaked to dimerize the diolefins. The dimers are separated and heated to 400°-700°F in order to crack the dimers of cyclic diolefins to monomers; the dimers of non-cyclic diolefins are not cracked. The remaining dimer fraction is polymerized with BF_3 at 0-200°F for 10-30 minutes. Hamner in 2,753,382 claims a process for preparing polymer oils from steam cracked fractions boiling between 100-115°F. These fractions, containing 40-50% piperylene, are polymerized with BF_3 at temperatures from −20° to +40°F. An unsaturated, steam cracked fraction (B.P. 20°-170°C) is polymerized by aluminum halides according to a method of F. W. Banes and J. F. Nelson (2,754,288 to Esso Research). During polymerization of this fraction, which has been freed of diolefins, there is added a mixture of the original fraction and another fraction containing at least 60% cyclopentadiene. The polymerization is carried out between −30° and +90°C. In 2,758,988 (F. W. Banes, J. F. Nelson, H. K. Wiese to Esso Research) an extract is polymerized in the presence of aluminim halide at −20° to +95°C. The extract is prepared from a steam cracked fraction boiling between 35-280°C by solvent extraction with diethylene glycol, polyethylene glycols, or β_1 β' oxydipropronitrile. A. W. Hubbard, R. F. Leary, and F. W. Banes (2,764,577 to Esso Research) separate a steam cracked naphtha into a fraction boiling below 38°C, containing all the isoprene, and a fraction boiling above 38°C. Then, to the high boiling cut is added a mixture of C_5 olefins containing more than 50% isoprene; this mixture is added in amounts such that the resulting solution contains 5-20% isoprene. The final solution is polymerized with aluminum halide at −30° to +90°C.

Synthetic resins are produced according to B. R. Tegge and F. W. Banes (2,770,613 to Esso Research) by polymerization of a fraction boiling above 130°C which contains more than 70% β-methyl styrene and indene and less than 5% diolefins. Polymerization is catalyzed by a solution of aluminum chloride in ether and takes place at −10° to +30°C. In 2,773,051 (R. F. Leary to Esso Research) a C_5 steam cracked fraction is freed of cyclopentadiene and then blended with 10-50% of cyclopentadiene dimers. The resulting solution is polymerized with aluminum halides to produce resins. Resins are also made according to G. P. Hamner and T. G. Jones (2,775,575 to Esso Research) by heating a steam cracked fraction, boiling from 18°-85°C, in order to dimerize all the cyclodienes. The undimerized material is recovered and polymerized in the presence of Friedel-Crafts catalysts at −18°C to +66°C. A similar procedure is claimed by G. P. Hamner, T. G. Jones, J. A. McDaniel, and M. C. Fuqua (2,775,576 to Esso Research) with polymerization being carried out at −4° to +38°C. In 2,779,750 (M. C. Fuqua and G. P. Hamner to Esso Research) a cracked stream boiling between 80-300°F is subjected to treatment with predried clay at 250°-300°F and 0.5-2 volume space rate. The unreacted naphtha is separated from the polymer and subsequently polymerized with Friedel-Crafts catalysts.

F. W. Breuer and B. F. Hofferth (2,736,723 to Armstrong Cork Co.) claim to modify hard, brittle resins from unsaturated petroleum fractions by heating the resins in the presence of higher aliphatic or aromatic mercaptans.

Polymerization Catalysts and Methods: This section is devoted to those patents dealing primarily with catalysts for polymerization or with methods for carrying out the reaction.

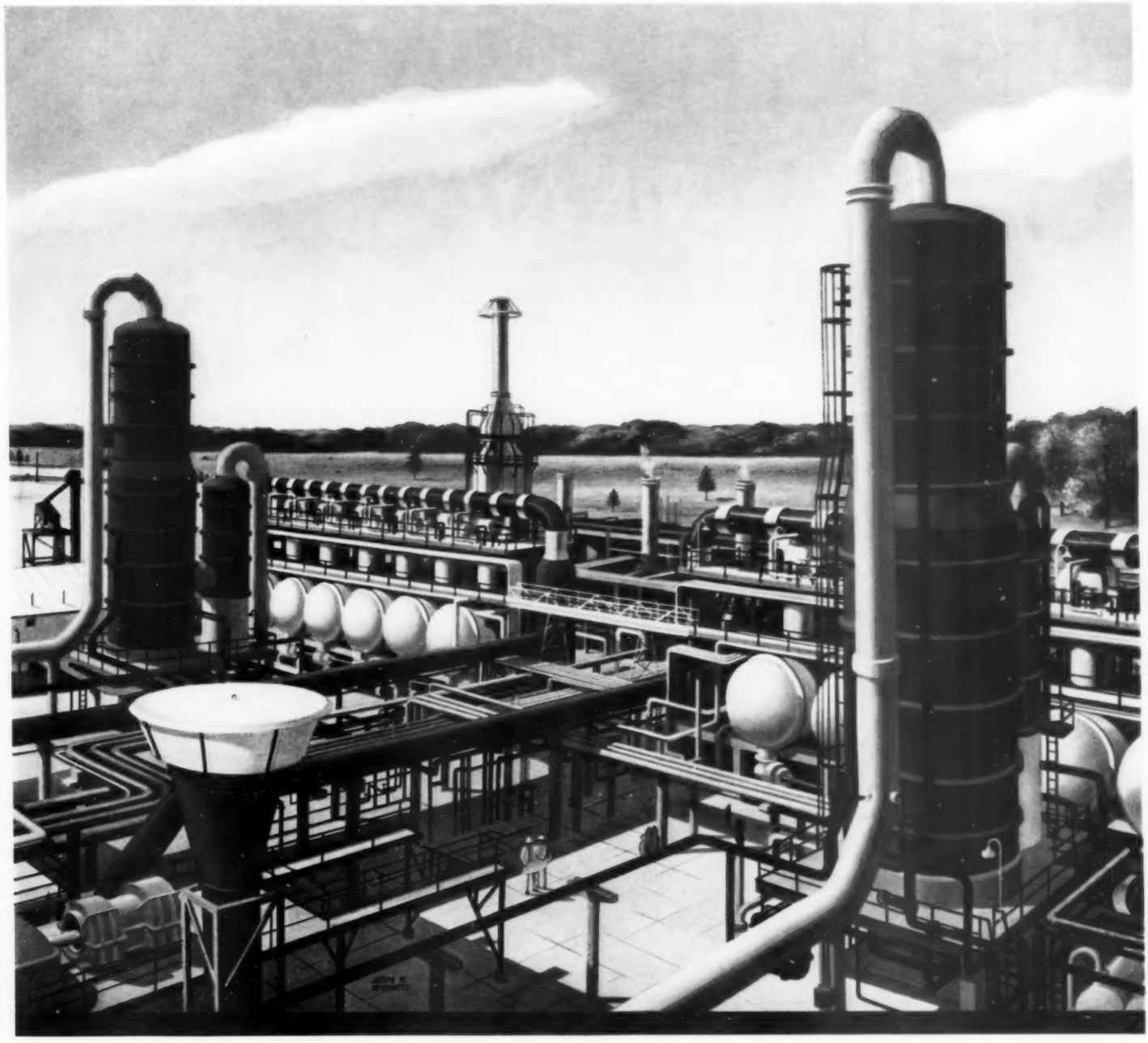
In 2,729,624, E. G. Howard, Jr., of the du Pont Co. proposes an aqueous polymerization method using as catalyst a combination of a water soluble hydrazine disulfonate and an oxidizing agent, such as soluble bromates, iodates, and periodates. A continuous slurry process for polymerizing C_3-C_4 olefins with solid catalysts is proposed by R. H. Mueller in 2,755,324 assigned to Esso Research. The reactor contains both liquid and vapor phases, has a lower narrow zone containing a dense suspension and an upper, expanded zone allowing settlement of the catalyst. E. Arundale and B. M. Vanderbilt (2,758,143 to Esso Research) claim a process for olefin polymerization to liquid polymers. The process comprises contacting the olefins with a mixture of an inorganic acid of phosphorus and an ester of phosphoric acid containing at least one aromatic group. Polymerization of olefins to dimers and trimers (J. H. Karchmer and S. R. Bethea in 2,759,033 to Esso Research) is caried out by contacting the olefins with a mixture of liquid phosphoric acid, assaying 100-105% H_3PO_4, and a white oil. The acid-oil mixture is prepared with the ratio of acid to oil of 1:4.3. The reaction is carried out at 250°-500°F and pressures from atmospheric to 1000 psig. A two stage olefin polymerization process is claimed by I. Mayer and E. J. Gornowski (2,766,311 to Esso Research). Olefins are contacted with a supported phosphoric acid catalyst to polymerize a substantial proportion; the product is then reacted with liquid phosphoric acid to polymerize substantially all of the olefins. G. E. Serniuk in 2,766,312 (to Esso Research) continuously polymerizes olefins to gasoline in a reaction zone containing a finely divided oxide of a metal in Group 6a. Olefin, BF_3, and a polar compound are continuously fed into this zone and product is continuously withdrawn. The polar compound is one capable of forming a complex with BF_3, e.g., water, alcohol, etc. In 2,767,234, L. Dauber and S. B. Sweetser of Esso Research patent a multiple reactor slurry system for polymerization of olefins using a supported phosphoric acid catalyst. An olefin polymerization catalyst is claimed by E. S. Corner and C. S. Lynch (2,778,804 to Esso Research); the catalyst is prepared by mixing silica hydrogel and phosphoric acid, drying, and calcining. A method for maintaining catalyst activity is claimed by E. Arundale, G. E. Serniuk, and F. A. Biribauer (2,786,878 to Esso Research). In processes using as catalyst a mixture of phosphoric acid and an ester of phosphoric acid, the catalyst gradually becomes contaminated with hydrocarbons, suffering a reduction of activity. The activity can be kept at a high level by controlling free hydrocarbon content to a level less than 20%. According to J. O. Smith, Jr., and I. Kirshenbaum (2,772,317 to Esso Research) an olefin polymerization catalyst can be prepared by impregnating a solid, adsorptive material with 25-90 weight percent of oxalic acid.

Miscellaneous Polymerization Patents: The following group of patents deals with some miscellaneous polymers and polymerization reactions of hydrocarbons.

A. C. Dees of the Phillips Petroleum Co. (2,720,509) claims sulfur containing, resinous polymers made by reaction H_2S and 4-vinylcyclohexene-1 in the presence of a liquid acid catalyst at temperatures from 0-300°F. In 2,729,610 (H. Ehring and K. Raiche to Farbenfabriken Bayer, A.G.) vinyl aromatics are polymerized in the presence of an ester of a polyvalent alcohol containing the radical of a higher, unsaturated acid.

An insoluble, cation exchange resin is claimed by E. W. Lane (2,731,426 to Rohm and Haas Co.). The polymer is prepared by copolymerizing dicyclopentadiene and maleic anhydride followed by sulfonation of the copolymer so that the chains are cross-linked by sulfone groups.

H. W. Wehr and F. B. Nagle (2,732,371 to Dow Chemical Co.) carry out the polymerization of vinyl aromatics in the presence of 0.001-5% of an unsaturated dimer of an α-alkyl styrene. In another Dow patent (2,739,142 by C. Jones, B. Harris, and F. L. Ingley) a molecular weight control method is claimed for styrene-acrylonitrile copolymers. A mixture of 20-35% acrylonitrile, 80-35% styrene, and 0-30% α-methylstyrene is heated to 130-175°C in the presence of 10-40% of a modifier comprising a monocyclic aromatic compound, e.g. benzene or chlorinated benzene. END



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The new Houston plant of Texas Butadiene & Chemical Corporation is now on stream with two 43,000 ton-per-year Houdry Dehydrogenation Units. In a single-step process, these two units transform butane feed into desired proportions of butadiene and butenes. They can provide 65,000 tons of butadiene and enough butenes for 2.5 million barrels of light alkylate. Or, by recycling butenes, it is possible to produce up to 86,000 tons-per-year of butadiene alone. This process employs a Houdry Chrome-Alumina Catalyst which in exhaustive tests has demonstrated its selectivity, ruggedness, and stability.

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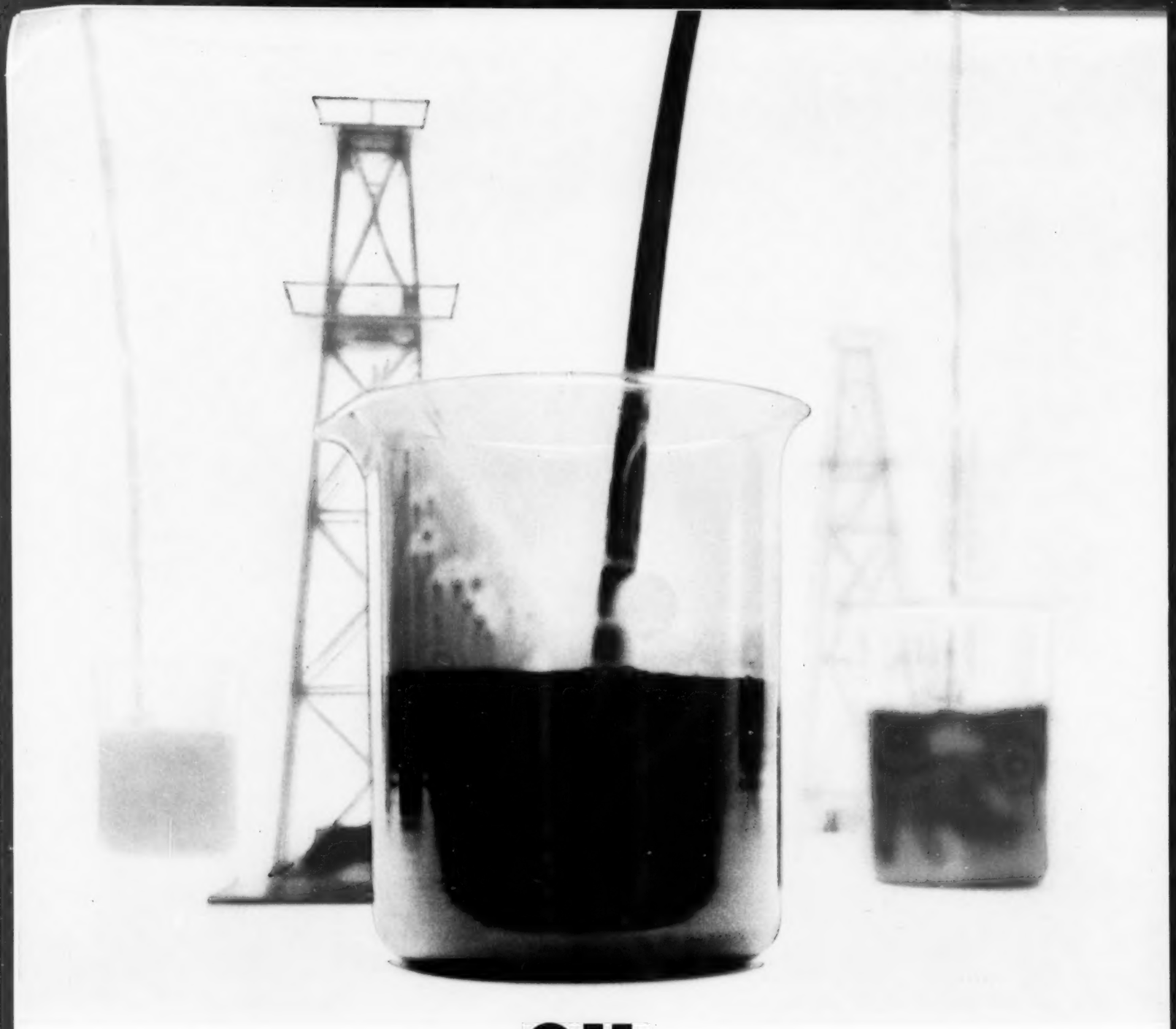

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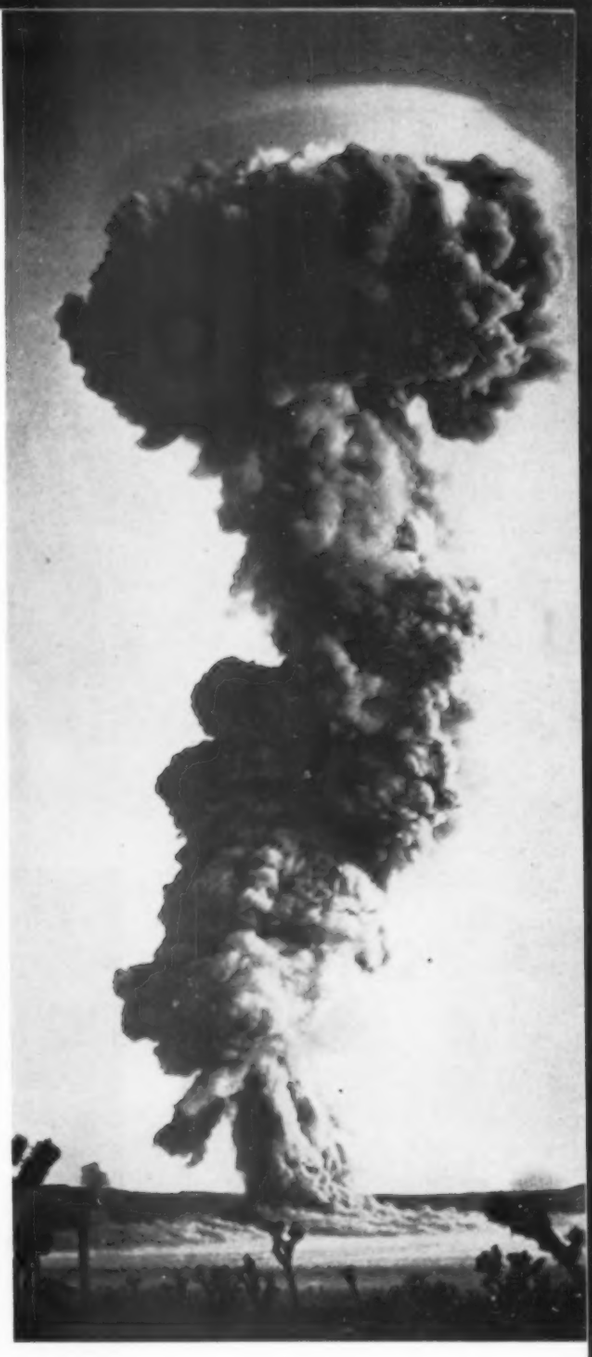


Suez crisis spurs hunt for new energy sources

by Eric Eltham

European countries speed plans for greater use of atomic energy. England visualizes an atomic power demand nearly equal to oil by 1975. Euratom countries plan 15 million kilowatts from the atom in 1967. USA plans 24 plants to consume atomic energy equaling 27 million barrels of oil by 1965.

LABORATORIES throughout the world are looking—and finding—new sources of energy. Atomic fission is the most spectacular and the most promising new source of power, but there are many other unexploited and unconventional reservoirs of energy in nature which are being considered. Fusion, as opposed to fission, is but one; and anyone familiar with the literature on the subject will recall the serious approaches being made to the utilization of solar energy.

Just why is there all this activity? This is not an easy question to answer; but, as a starting point, we may say that the new generation of scientists and engineers—uninhibited by the classical mechanics and physics of their fathers—are dreaming of a new age whose limits are beginning to encompass the solar system, if not beyond. Second, present sources of energy, while for the most part adequate, are unevenly distributed, and in many parts of the world their scarcity puts a definite bar on economic progress.

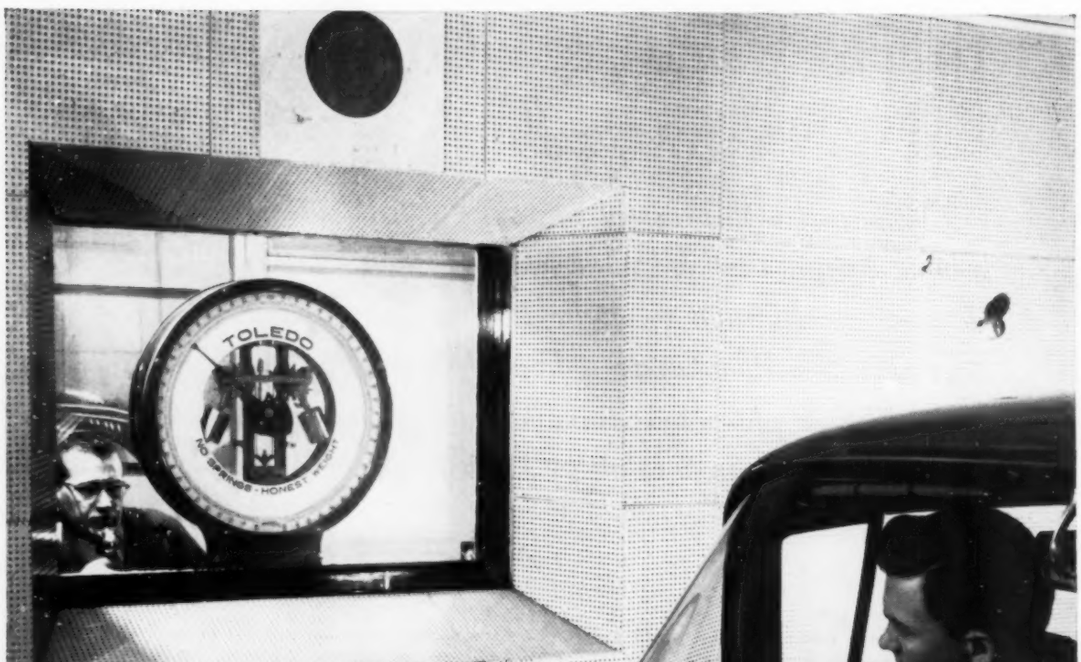
Before examining some of the proposals for new sources of energy, we may consider briefly our resources of conventional forms of energy. These are coal, oil, and hydroelectric power. Coal and oil are used to create heat which is turned into mechanical energy. Hydro power, on the other hand, harnesses the power of gravity to produce electricity. Electricity, of course, can be produced from coal and oil, but three steps are involved: the conversion of the chemical energy of the fuel into heat, heat into mechanical energy, and the mechanical energy into electricity. One step less is involved in the harnessing of water power, and the efficiency of conversion is consequently greater.

There are many ways of measuring energy. A purchaser of coal, for example, buys it by the ton—a practice which has encouraged some sharp dealers to wash their product prior to weighing it. Petroleum is generally sold by the gallon, and sometimes tabulated in tons; gas by the cubic foot; and electricity by kilowatt-hour. To express the heat content of these fuels, we find it convenient to use the British thermal unit (Btu) which, it will be recalled, is the amount of heat required to raise 1 lb of water 1 deg F. The Btu content of the abovementioned sources of energy are approximately as follows:

Ethyl Research
Performance of Today's

by T. W. Warren

Director, Refinery Technology, Ethyl Corporation Research Laboratories



A premium fuel being road tested in one of Ethyl's controlled-weather rooms that duplicates road conditions exactly.

Reports on Premium Fuels

NINETY-ONE premium gasolines and 12 third-grade super-premium fuels have been tested on the road and in the laboratory in a research program recently completed by Ethyl's Detroit Research Laboratories.

The results of this investigation have been published in a 140-page report entitled "Antiknock Behavior of Premium Motor Fuels, 1957", now available to all companies in the Oil and Automotive Industries.

The fuels tested were submitted by 83 refineries of 48 American companies. These refineries produce 75 per cent of the motor fuel in the United States. Seven Canadian companies, producing an appreciable percentage of Canada's gasoline needs, also submitted fuel samples for testing.

Each Gasoline Tested 32 Times

Five 1957 cars normally requiring premium fuels, and three cars equipped with experimental 11 to 1 compression-ratio engines were used in the tests. A minimum of two Modified Uniontown and two Modified Borderline ratings were obtained for each gasoline in each car, a total of at least 32 road ratings for each fuel sample.

Extensive laboratory data, including determinations of tetraethyllead susceptibility, hydrocarbon type, and bromine number, were also obtained and are included in the report.

Test Results Point to Future Gasoline Developments

The broad sampling of premium fuels tested gave an accurate picture of today's premium gasolines and how they perform in the cars of today and in the higher compression engines of tomorrow. A complete analysis of all the test data led to the following conclusions affecting refining economics:

1. Sensitivity (the difference between Research and Motor octane number) often is an unreliable measure of road performance through the normal speed range.

2. Research and Motor octane numbers can be used to predict road performance at low speeds but are less reliable at intermediate and high speeds.

3. At higher speeds, road performance increases when the aromatic content of the gasoline is increased.

The 103 premium and super-premium gasolines in these drums were tested for Ethyl Corporation's 1957 premium fuel survey. This is the fifth premium survey conducted by Ethyl since 1946.

An important by-product of this program was the development of a system for calculating the road octane number of a gasoline. This development will permit individual refiners to determine the "road octane number" of their gasoline blends using the results of simple laboratory tests.

How Ethyl Research is helping you

Since World War II, Ethyl Corporation has investigated the laboratory and road performance of premium-grade gasolines in 1946, 1949, 1951 and 1954. During this period, the number of fuels analyzed has increased from 12 gasolines in 1946, to 63 in 1954 and 103 in 1957.

"Antiknock Behavior of Premium Motor Fuels, 1957" is one more example of Ethyl's continuing service to the Oil Industry. Copies can be obtained from your Ethyl Representative or by writing Ethyl Corporation, 100 Park Avenue, New York 17, N. Y.

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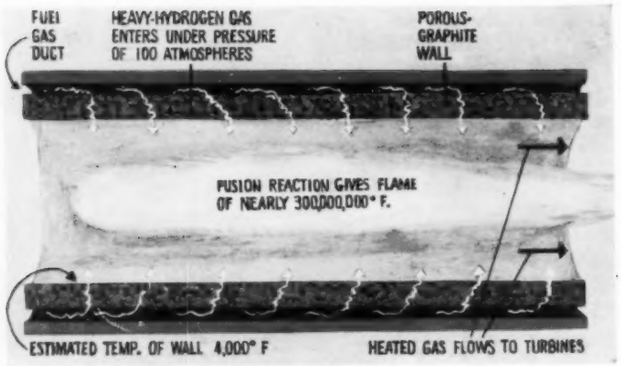

FUEL GAS DUCT
HEAVY-HYDROGEN GAS ENTERS UNDER PRESSURE OF 100 ATMOSPHERES
POROUS-GRAPHITE WALL
FUSION REACTION GIVES FLAME OF NEARLY 300,000,000° F.
ESTIMATED TEMP. OF WALL 4,000° F
HEATED GAS FLOWS TO TURBINES

SECTIONAL VIEW of H-power furnace (inset above) shows scheme to enable it to withstand flame temperature of millions of degrees. Incoming fuel gas would cool porous-graphite walls and keep flame away from them, by interposing a zone too cool to support H-reaction. Furnace's giant dimensions are compared below with size of world's largest liner and tallest building.

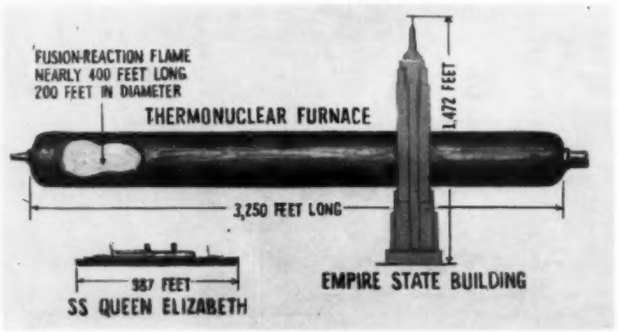


Fig. 1 Concept of thermonuclear furnace for generating power. Source: Popular Science Monthly, *March 1957.*

	Btu
1 lb of coal	13,000
1 lb of petroleum	18,900
1 bbl of petroleum	4,742,800
1 cu ft of natural gas	1,000
1 kilowatt-hour of electricity	3,410

The Btu, when used to measure gross energy consumption, becomes like the dollar when the latter is used to express the national budget. The resulting figures are astronomical; and, therefore, it is convenient to talk in terms of hundred million million Btu's or, in brief, HMM's. World consumption of energy during 1956 of all types is estimated at 835 HMM Btu's. This is equivalent to 17.6 billion barrels of petroleum—and, in passing, it is interesting to note that petroleum actually did supply five billion barrels of this demand, or 28.4%. Coal, it is estimated, was responsible for 44.5%. Sometimes energy is measured, for purposes of comparison, in ton equivalents of coal. On this basis, one ton of petroleum is approximately equivalent to 1.45 tons of coal.

It will be some time before new energy sources make any significant inroads on the overall energy requirements of the world, but we cannot escape the fact that atomic energy has begun to supplement the fossil fuels in the generation of power. Great Britain leads the world in the harnessing of the atom, having opened its Calder Hall atomic-power station on October 17, 1956. This is the first full-scale nuclear-powered station in the world, and has a capacity of about 70,000 kw. Preliminary reports seem to indicate it is producing electricity at a cost which is competitive with that of a modern steam plant using domestic coal. Actually, the experience with the Calder Hall installation is too limited to permit accurate cost figures; and it is also no secret that, from a power-generating point of view, it is not the most efficient type of installation. It was designed to produce plutonium, a fissile material, as well as power. Future plants will be designed primarily to produce electricity.

Great Britain is firmly committed to expand its atomic power. The closing of the Suez Canal brought about a drastic revision of the government's plans, and it would not be giving too much credit to President Nasser to say that he has done as much as, or more than, any man to promote atomic power in England and Western Europe. Since the closing of Suez, Britain has announced plans to bring 19 nuclear power plants into operation by 1965. These will have a capacity of six million kilowatts, and will supply the energy in one year which could be provided by 18 million tons of coal. This announcement triples the plans which the government had laid down in 1955. In that year, the UK's consumption of fuel, in terms of million tons of coal equivalent, was:

Coal	214
Oil	35
Water power	1
	250

By 1975, the production of coal in Britain may have reached 235 million tons; while the demand for fuel, in terms of millions of tons of coal equivalent, is placed at 373. This means energy equivalent to that available from 138 million tons of coal must be supplied by other fuels. Conservative estimates point to nuclear energy giving the equivalent of 40 million tons—although experts of a more optimistic frame of mind say the figure will be 70 million tons. Leaving aside water power—which can be expanded only slightly—oil will have to account for from 60 to 90 million tons of coal equivalent in Britain by 1975, or 2,4 times the petroleum requirement in 1955.

Equally determined to exploit nuclear energy and to enjoy the independence it

General view of Calder Hall atomic-power station (photo by UK Atomic Energy Authority).

promises are the six Euratom countries--France, Italy, West Germany, and the Benelux countries. In a joint report issued in May this year, these countries set a goal of 15 million kilowatts by 1967. Cost of this program is estimated at $6 billion. In addition to providing electric power, nuclear energy can be used to produce heat—and Germany is planning to build a plant aimed at providing process heat for industry and space heating for residential buildings.

The United States has conducted atomic research on a scale which is unsurpassed, but it has not rushed into the building of plants for nuclear power because the great abundance of fossil fuels makes any competitive system subject to economic restrictions which do not exist in countries where oil and coal are scarce. Commenting on this situation, Chairman Strauss of the Atomic Energy Commission said:

"To become economic, nuclear power must meet more stringent requirements in the US than in any country because of low-cost fossil fuels."

Nevertheless, the AEC has announced there will be some two dozen nuclear power plants in operation in the United States by 1964. The first large-scale unit, an installation of 60,000-kw capacity, will begin producing power for the Duquesne Light Co., at Shippingport, Pa., this year. Experimental plants are also operating, or scheduled to operate, this year at Santa Susana and Pleasanton-Livermore, Calif.; and Oak Ridge, Tenn. In Lemont, Ill., the AEC began operating a small plant in February this year at its Argonne laboratories. The power from this installation is used to illuminate the laboratory buildings and to operate equipment. It is probably similar to the plant the commission has been operating in Arco, Utah, for the past two years.

Dwarfing the Shippingport plant is the 275,000-kw station which is scheduled to go into operation in 1960, just outside the city of New York, for the Consolidated Edison Co. This will be capable of supplying 5% of the needs of the metropolitan area. The same year will see a 180,000-kw plant completed at Dresden Station, Ill. The 24 plants listed below—if and when completed—will have, it is estimated, a capacity of 1.5 million kilowatts. This is equivalent to the energy produced by five million tons of coal or 27 million barrels of petroleum. However, this capacity, it is worth noting, is less than half the power developed by Norway's hydroelectric stations and only one-tenth that scheduled for Western Europe's-nuclear power plan:

DATE	*LOCATION*
1957	Shippingport, Pa.
	Fort Belvoir, Va.
	Oak Ridge, Tenn.
	Lemont, Ill.
	Pleasanton-Livermore, Calif.
	Santa Susana, Calif.
1958	(none)
1959	Arco, Idaho
1960	Elk River, Minn.
	Dresden Station, Ill.
	Lagoona Beach, Calif.
	Indian Point, N.Y.
	Rowe, Mass.
1961	Hallam, Nebr.
	Hersey, Mich.
	Piqua, Ohio
1962	Northwestern Minnesota
	Central Ohio
	Central Florida
	Eastern Pennsylvania
1963	(none)
1964	New England area
1965	Central Ohio
No announced date:	Northern California
	Northern Louisiana
	Central North Carolina

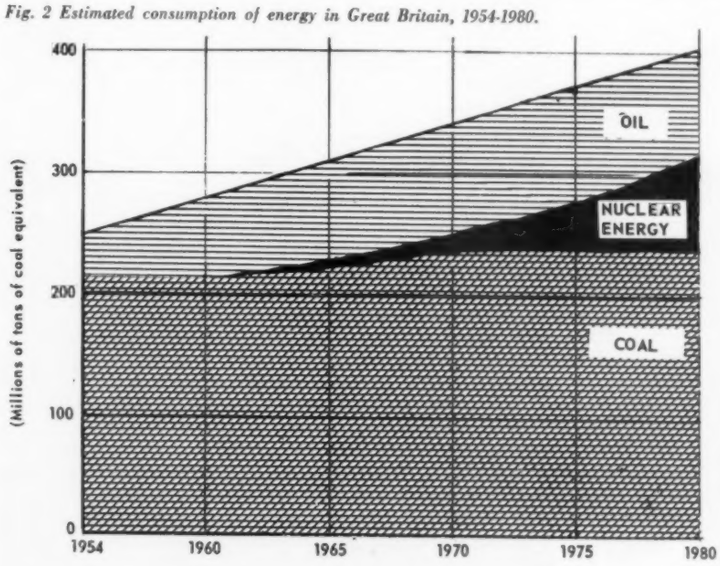
Because atomic fuel takes up little or no space when compared with conventional fuels, it is destined to revolutionize the transportation aspects of the power industry. This fact is driven home with dramatic impact by the record of the atomic submarine, the "Nautilus." On a 20,000-league or 60,000-mile voyage which has just been completed, 8¾ lb of uranium were consumed. If petroleum had been used, the consumption would have been 18 million pounds, or 57,140 bbl.

From the point of view of the armed services, this saving in transportation can increase immeasurably the mobility of forces in the field. And as new weapons come into service—particularly the guided missiles—the need for power-generating equipment becomes even more important. Heat, light, launching gear, oxygen-generating apparatus, etc.—not to mention instrumentation and associated equipment such as radar—mean that a missile base must have power available in large quantities. The problem is intensified by the fact that these bases may be in remote locations on deserts or in arctic regions. As far back as 1952, the Corps of Engineers of the US Army decided that a need existed for a family of packaged nuclear power plants. The installation at Fort Belvoir, mentioned in the foregoing tabulation, is the first Army package power reactor, APPR-1. It completed a 700-hour performance test in July.

APPR-1 is a prototype and, therefore, is far from being the packaged unit which the services require. However, its basic components form the basis of the mobile unit which is the end product of this program. Extra precautions involving extensive safety devices were taken with this unit because it is a prototype—and also because it is located near Washington, D. C. Reports state that it can run for 18 months on one fuel charge which will be equivalent to 60,000 bbl of fuel oil. The program of which APPR-1 is the first prototype calls for three categories of military nuclear power plants. The first category is concerned with fixed installations for generating power at locations where it will be difficult, if not impossible, to obtain conventional fuels. The second category has as its goal the development of highly portable power-generating units which can be mounted on trailers, flat cars, or barges with essentially no need for fuel or water. In the third category falls a series of propulsion systems for land vehicles, including a nuclear-powered snow train for use in exploring the arctic and for supplying arctic bases.

The nuclear power reactors being planned and installed in this country and in Europe depend on nuclear fission. Chief difference between Britain's Calder Hall installation and the units designed by our AEC lies in the heat-transfer medium used. The British are using carbon dioxide, while American plants are designed around a pressurized water system—although the plant in Santa Susana, Calif., which has just gone into operation, uses sodium as the heat-transfer medium. The second atomic-powered submarine of the US Navy used a sodium-cooled reactor, but the Navy has taken it out and substituted pressurized water. Dr. W. F. Libby, of the AEC, estimates that the current series of reactors will produce electricity at a cost of 10 mills per kilowatt-

Fig. 2 Estimated consumption of energy in Great Britain, 1954-1980.



hour, or perhaps less. This compares with four-mill power which is available to the AEC in large blocks. Britain's Ministry of Fuel and Power estimates that, while today a ton of uranium can be made to do the work of 10,000 tons of coal, developments will lead to the point where each ton of uranium will be equivalent to a million tons of coal.

"The cost of electricity may then drop," says the Ministry, "substantially below that of electricity generated in conventional stations. The possibility of other reactors includes breeder reactors, which produce more fissile material than they consume. Six other reactor systems are also being developed now, while the fusion process (as used in the hydrogen bomb) is a dramatic development which lies in the future."

Both Britain and the United States are working hard on controlling thermonuclear power, or the power of fusion, so that it can be used for peaceful purposes. Here the problem is one of building a reactor which will withstand the heat generated during the fusion process. Temperatures range from 100 to 400 million degrees. Containers of conventional types are, of course, out of the question; but Lewis L. Strauss, AEC chairman, disclosed that commission scientists are working on a "magnetic bottle."

"Electrically-charged particles," said Mr. Strauss, "can be controlled by magnetic lines of force, supplied by suitable coils or by powerful electrical currents passing through the plasma itself.

"The magnetic lines of force cause any ionized particle to be deflected wherever it tries to cross them. The particles, instead of crossing the lines, are compelled to spiral around them. Thus, with the "Magnetic Bottle" we seek to throw up invisible barriers to prevent the plasma from coming into contact with the walls of the tube.

"The scientists believe it will be possible, in such a system, to contain the plasma at a temperature of more than 100 million degrees, while the walls of the container remain relatively cool, or at least well below the melting point of the material."

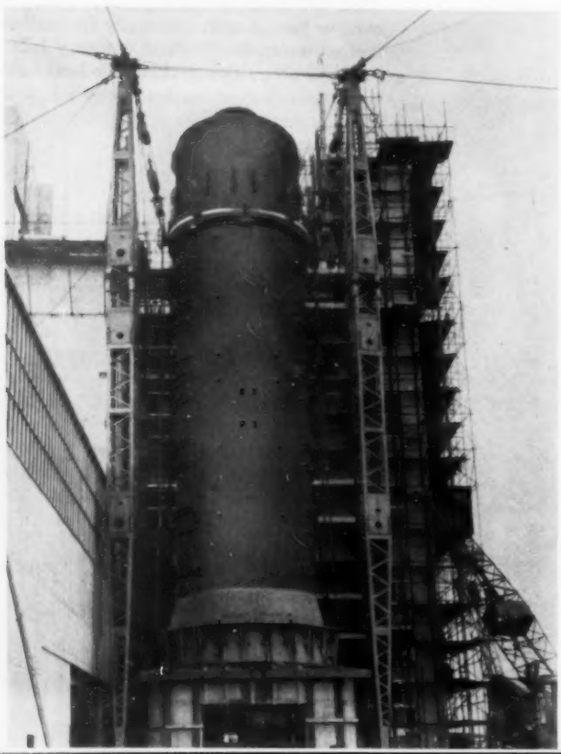
A reactor employing this principle has been proposed by Dr. Hsue-shen Tsien. It would be of graphite, 325 ft in diameter and 3,250 ft long. Cooling would be augmented by forcing heavy hydrogen through the porous walls of the reactor at 100 atmospheres. The gas would form an insulating layer between the reaction zone and the walls of the chamber. Hot gases from the reaction would drive a battery of gas turbines which, in turn, would drive generators. A plant of this size would produce 300 million kilowatts, or more than all the generating capacity in the USA today.

It would seem improbable that such a proposal would become a reality for several years because there are so many problems in addition to the heat problem to be solved. But, as has been demonstrated time and time again, need can be the catalyst which turns the improbable into reality. Down in Texas, where natural gas provides stiff competition for any type of fuel, the fission process would be out of the running. Looking to the future, 11 Texas utility companies have banded together and formed the Texas Atomic Energy Research Foundation, a foundation which will study controlled fusion. Cooperating with the foundation in the four-year multimillion-dollar program is the General Atomic Division of General Dynamics Corp. General Dynamics, it will be recalled, built the first atomic-powered submarine, the "Nautilus." Commenting on the Texas program, Mr. Strauss said: "I regard this as a significant demonstration of the vitality of the pioneering spirit of American enterprise."

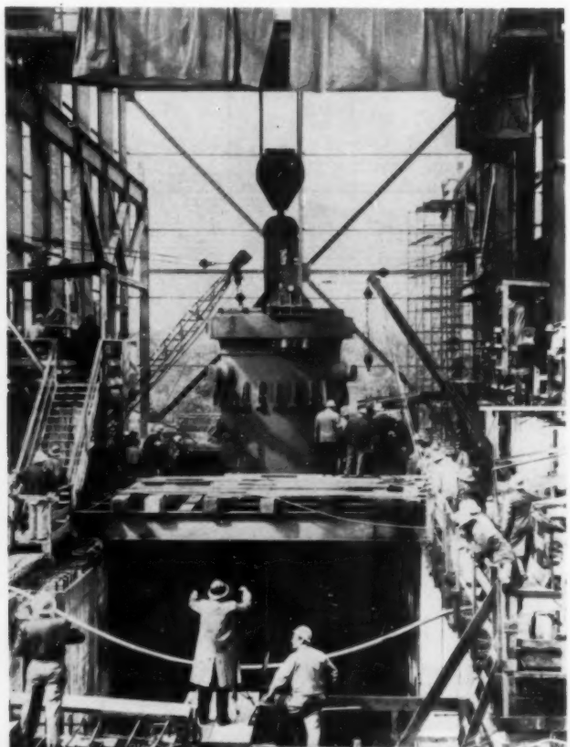
Private vs. public building of nuclear power plants has turned into a partisan matter which is being hotly debated before the Joint Congressional Committee on Atomic Energy. Undoubtedly, the outcome of this debate will affect the plans of the Texas venture. In attacking the problem of harnessing the power of fusion, the Texas group is paralleling the research being conducted by the AEC's Project Sherwood. At the same time, General Electric has disclosed it, too, is doing basic research on controlling the fusion reaction.

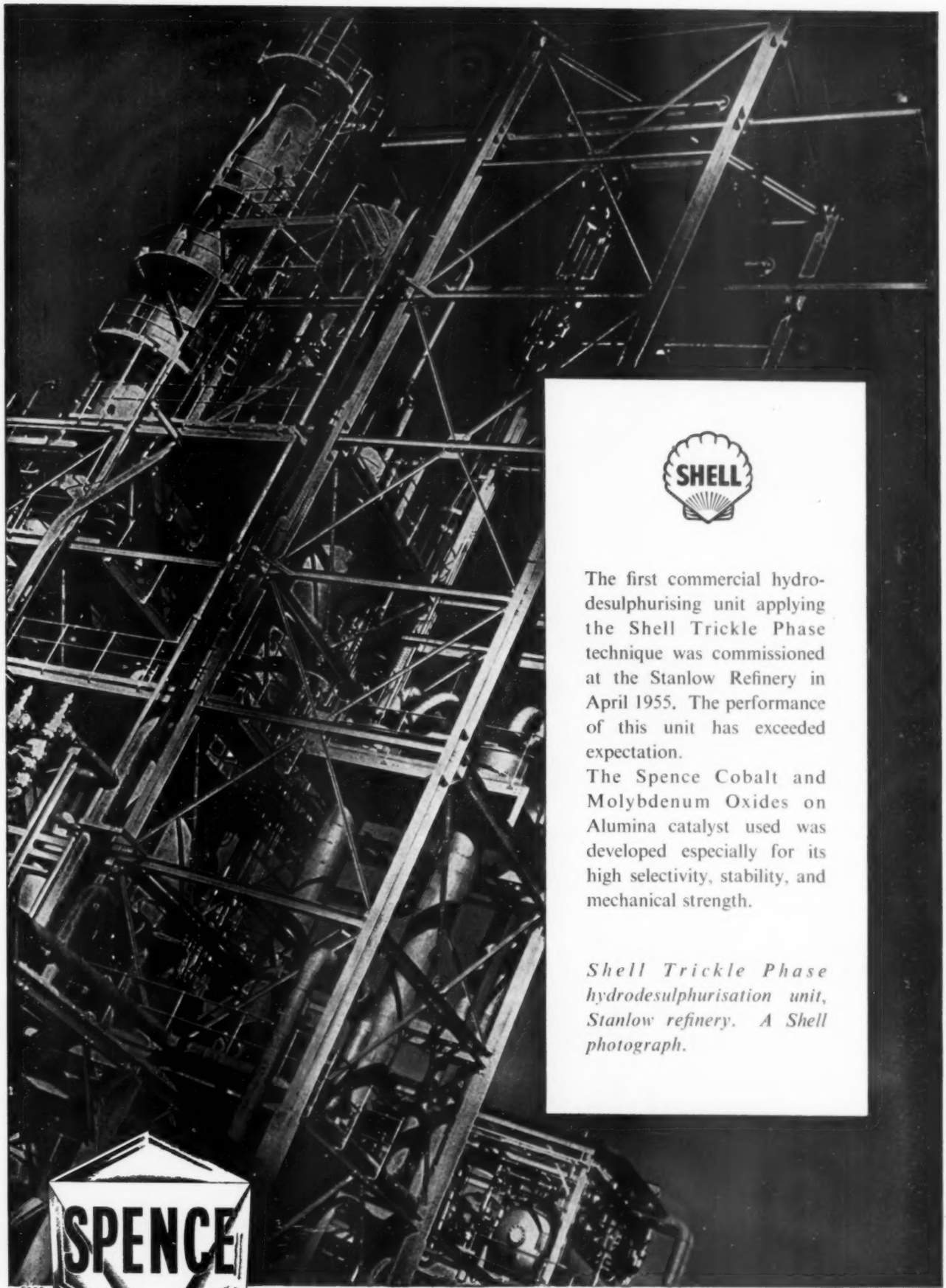
On the basis of progress to date, we can be sure that, even should a major technological breakthrough appear in the field of fusion or fission, nuclear power plants will be able to do little more than help supply the increasing power needs of the country—and the demand for fossil fuels will also climb. The day will undoubtedly come when nuclear fuel will replace coal and oil in the generation of power, but it will not be in this generation—and probably not in the next. Furthermore, those countries, such as the United States, which have an abundance of coal and oil will be among the last to convert completely to the power of the atom. END

Here one of the 80-ft steam-generating towers is being erected at the Calder Hall atomic-power station (photo courtesy of Babcock & Wilcox).



235-ton reactor vessel, about three stories high, is being lowered into position at PWR atomic power plant under construction at Shippingport, Pa. (photo courtesy AEC Pittsburgh area office).





SHELL

The first commercial hydro-desulphurising unit applying the Shell Trickle Phase technique was commissioned at the Stanlow Refinery in April 1955. The performance of this unit has exceeded expectation.

The Spence Cobalt and Molybdenum Oxides on Alumina catalyst used was developed especially for its high selectivity, stability, and mechanical strength.

Shell Trickle Phase hydrodesulphurisation unit, Stanlow refinery. A Shell photograph.

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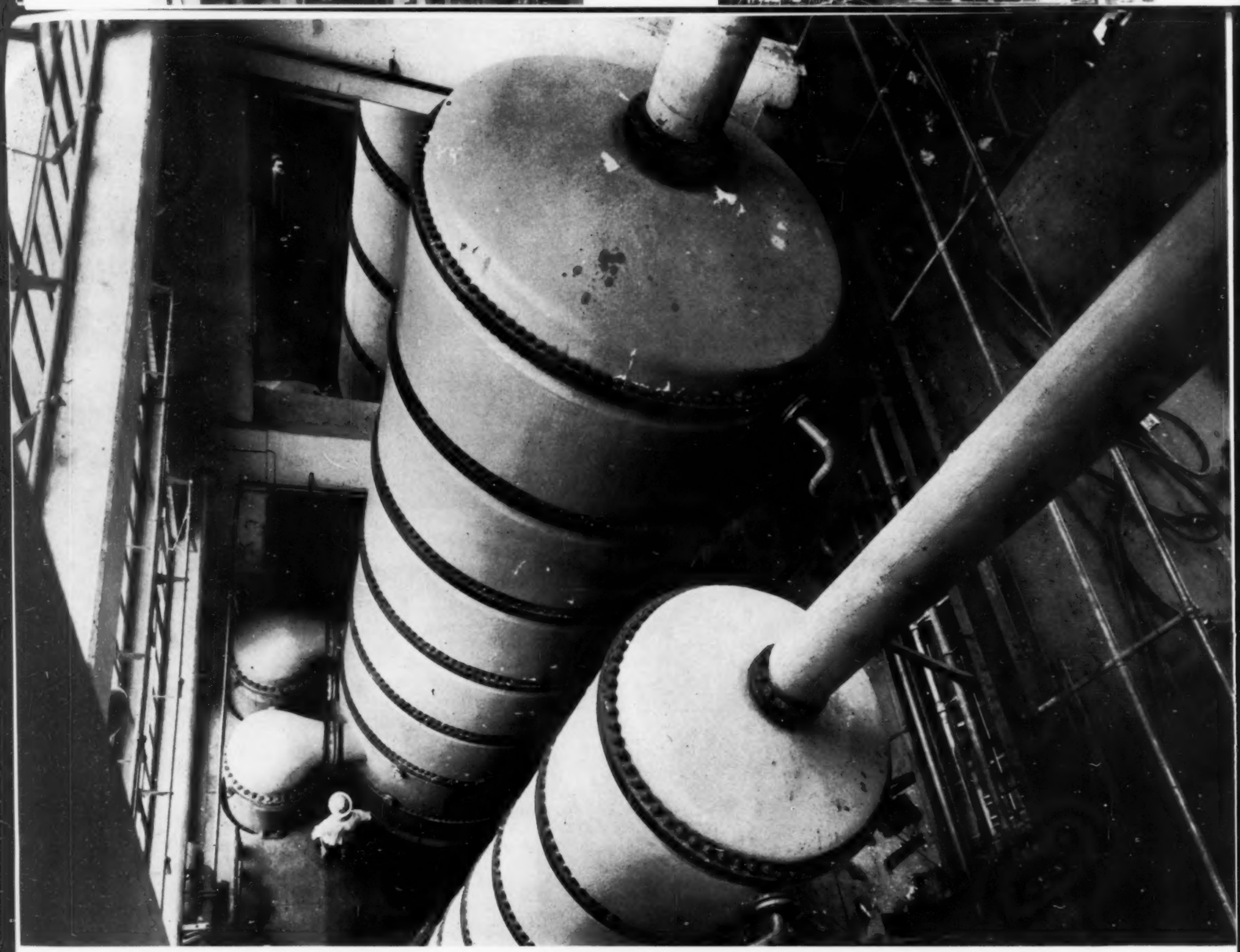


Top View of 120-In.-Diameter Acetophenone-Carbinol Refining Still in Ethyl Benzene Oxidation System at Institute, W. Va. (photo, courtesy Carbide & Carbon Chemicals Co.).

Petrochemical monomers for the synthetic rubber industry

PART II

In the September issue, Mr. Sherwood reviewed progress in petrochemical monomers for the synthetic rubber industry. This is a continuation of his review. Part III will appear in a subsequent issue.

by Peter W. Sherwood
Chemical engineer, White Plains, N.Y.

IN Part I of this series, we have discussed economic and market aspects of petrochemicals monomers for the synthetic rubber industry. Consideration has also been given to the raw-materials position for each of these intermediates. It will be the purpose of the subsequent discussion to present the manufacturing techniques by which petroleum hydrocarbons are converted to the five principal building blocks employed in the production of synthetic rubber: isobutylene, butadiene, styrene, acrylonitrile, and chloroprene.

This group falls logically into two divisions: derivatives of petroleum hydrocarbons, and products of acetylene.

The second of these groups covers only chloroprene and acrylonitrile. Their hydrocarbon intermediate is, at this writing, generated principally from calcium carbide. In recent years, however, production of acetylene from methane has found increasing acceptance and one producer (American Cynamid Co.) already uses this route as basis for the manufacture of acrylonitrile. In the case of chloroprene, methane-derived acetylene is not yet employed, but it offers a definite potential for future expansion. Chloroprene, as well as acrylonitrile, therefore, falls within the scope of our discussion. Methods for their manufacture will be covered in Part III of this article series.

The other leading monomers of the synthetic rubber industry are isobutylene, butadiene, and styrene. Their raw materials are hydrocarbons which are normally recoverable from refinery streams—ethylene, butanes, butenes, and benzene (note, however, that the bulk of ethylene is specially produced for petrochemical purposes to augment the natural refinery supply). It is with this group of monomers that the present installment will be concerned.

Production of Isobutylene: Isobutene is obtained commercially by the dehydrogenation of isobutane. Both of these hydrocarbons occur naturally in refinery fractions, but the supply of the olefin is insufficient, so that its production from isobutane is necessary.

During the war years, a significant portion of the nation's demand for isobutane (for aviation alkylate and for butyl rubber) was covered by isomerization of n-butane. Five different processes were employed. Two of these, carried out in the vapor phase, used $AlCl_3$ on Porocel as catalyst. In the other three processes, $AlCl_3$ (in one instance, promoted by antimony trichloride) served as catalyst in liquid-phase isomerization. Details of these operations have been described by the author elsewhere[7].

Today, such isomerization processes find their principal application in the production of branched-chain pentanes, to be blended into motor gasolines. Isomerization of butane is practiced only on a very limited scale. There are two primary reasons for this: a decline in the percentage of alkylate employed in the gasoline pool, and the employment of reforming and catalytic cracking on a very large scale. In these operations, a high percentage of isobutane formation occurs.

The hydrogenation of isobutane is carried out catalytically in the vapor phase. Except in minor detail, the method resembles closely the dehydrogenation of n-butane which will be described below in the section on butadiene manufacturing processes. No further discussion in this place is, therefore, necessary.

Manufacture of Butadiene: Two methods are employed for the commercial production of butadiene from butane: A direct process in which butane conversion is carried out in a single stage, and a two-stage method which requires intermediate production and isolation of butenes.

As recently as 1956, the latter approach was employed by all but one USA producer of butadiene. Today's total installed capacity for the two-stage process is approximately 733,000 tons per year. While butane constitutes the bulk of the feed stock, some of the butene feed to the second stage is recovered directly from refinery gas.

The single-stage process is particularly attractive at times when there is a large price differential between butane and butene, as is the case at present. The method is versatile, and can be used for the manufacture of butadiene or butene, or both. It is employed at the 16,000-ton-per-year butadiene plant of Standard Oil Co. (California), located at El Segundo. It also serves at the plants of Texas Butadiene and Chemical Corp., Odessa Butadiene Co., and Firestone Tire and Rubber Co.—all three of which went onstream in mid-1957, adding 170,000 tons per year to USA butadiene capacity. One other single-stage butadiene plant (15,000 tons per year) was operated by Sun Oil Co. at Toledo, Ohio, during the war, but has since been dismantled.

The following paragraphs will give a brief technical description of these two methods for butadiene synthesis:

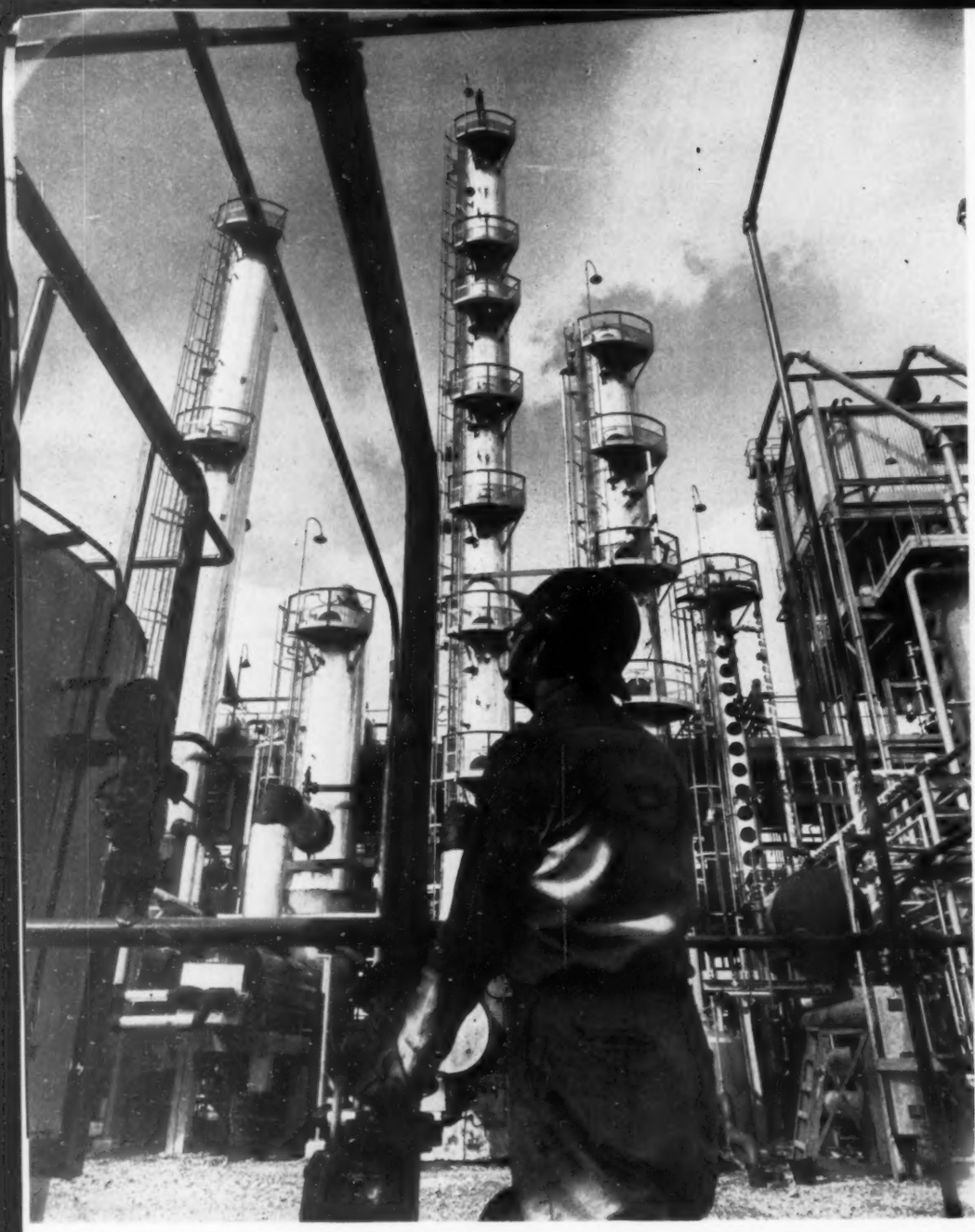
1. *The Two-Stage Process:* The first step in this route is the catalytic dehydrogenation of butane to a mixture of n-butenes:

$$C_4H_{10} \rightleftharpoons C_4H_8 + H_2 \text{ ----(1)}$$

This dehydrogenation reaction is improved by rise in temperature. The olefin content of the equilibrium mixture rises from 11.4% at 427 C to 24.5% at 500 C, and 41.9% at 600 C.

In practice, occurrence of cracking reactions limits the upper temperature to 600 C. This necessitates the use of highly active and specific catalysts. Chromia-

View of Koppers Co.'s Ethyl Benzene Plant at Port Arthur, Texas.



Ethyl Benzene Stills, Port Arthur Plant (photo, courtesy Koppers Co. Inc.).

alumina is in general use for this purpose. Catalyst composition at one commercial installation has been reported to be 8% CrO_3 and 1% to 2% K_2O, impregnated on activated alumina.

Contact time is a variable of critical influence on both conversion and yield. The optimum residence time depends on operating temperature and catalyst activity, and the choice is governed largely by the immediate production requirements. When reactor capacity is controlling output, high temperature and short contact time are chosen. This will result in large throughput and per-pass conversion, but at a sacrifice in ultimate yield.

Typical operation for high yield calls for 550 C and a recycle-charge ratio of 3.5. Per-pass conversion is 25%. On this basis, 1 lb butane will yield 0.85 lb butylenes, 0.03 lb hydrogen, and 0.01 lb C_1-C_3 hydrocarbons. The remainder goes to carbon or is unaccounted loss.

Catalysts in butane dehydrogenation service are fouled by carbon deposition. This problem is especially pronounced with sulfur-free feed stocks, and doping with 30 to 40 ppm carbon disulfide has been resorted to in several instances. In any event, catalyst regeneration becomes necessary after 1 to 3 hours. This is carried out by burning. Oxygen concentration is adjusted to restrict regeneration temperature below 700 C to 750 C to avoid damage to the catalyst.

A typical 2-hour production cycle calls for 60-min processing, 1.5-min purging, 58-min reactivation, and 0.5-min depressuring and purging.

Such a cyclic operation makes it necessary to employ several converters in parallel. These converters are gas-heated to provide the strongly endothermic heat of reaction. The catalyst is mounted in vertical tubes. Heat-transfer considerations necessitate high linear flow rate on the process side, and large pressure drop is, therefore, encountered.

Despite regeneration, the activity of the catalyst declines gradually. This effect must be offset by raising the temperature in small increments. Ultimately, the catalyst must be changed about twice per year after dehydrogenating some 2,300 lb butane per pound of catalyst.

The reactor effluent is a mixture of butanes and butenes. If the feed stock contained a significant amount of isobutane, the resulting isobutene must be separated by extraction with (65%) sulfuric acid.

Distillative methods serve for the purification of the remaining C_4 hydrocarbons. Straight fractionation is used to take isobutane and 1-butene overhead, leaving n-butane and 2-butane as bottoms. The components of each fraction may be separated by extractive distillation with furfural.

An alternate separation scheme eliminates the primary fractionation in favor of extractive distillation with acetone. This segregates the combined butenes from isobutane and butene. The recovered olefinic fraction may be used as feed to butadiene production without further separation.

Still another separating method recently announced is now in use at Shell Chemical's Torrance, Calif., butadiene plant. This process employs acetonitrile instead of acetone as extractive distillation solvent for separation of butanes and butylenes. Easier separation and lower solvent losses are reported than those achieved with acetone, thus permitting greater throughput in a given installation.

Conversion of butenes to butadiene takes place in accordance with equation (2):

$$n\text{-}C_4H_8 = C_4H_6 + H_2 \text{ ----(2)}$$

The reaction is endothermic (H-22,500 cal per gram-mole), and is strongly favored by high temperature and low pressure. Thermal cracking reactions set the upper temperature limit at 1,300 F. Practical operating range is 1,150 F to 1,250 F, and a per-pass conversion of 25% to 35% is taken.

Low partial pressure of hydrocarbon is achieved by diluting the feed stream with steam. This technique not only favors the dehydrogenation equilibrium of reaction (2), but also suppresses the strong tendency of butadiene to undergo polymerization. It has the further advantage of providing a ready vehicle for the introduction of the large required endothermic heat and of minimizing the need for catalyst regeneration by gasifying much of the coke as soon as it is formed.

Two catalysts are in commercial service for butene dehydrogenation. Standard Oil Development Co.'s Catalyst 1707, which assays 72.4% MgO, 18.4% Fe_2O_3, 4.6% CuO, 4.2% K_2O, has been the workhorse of the industry. Of late, a calcium-nickel-phosphate catalyst, developed by Dow Chemical Co., has found growing acceptance in the industry. The advantages of Catalyst 1707 include lower steam consumption and higher throughput at a given conversion

THE "EVGENIA NIARCHOS"

sister vessel to the highly successful *Spyros Niarchos*, is now in service. On an overall length of 757 feet, she carries 47,000 tons deadweight and has a maximum power of 20,000 S.H.P. Her propeller, like that of the *Spyros Niarchos*, is the largest manufactured in Novoston alloy. It is of Heliston design, five-bladed and weighs 30½ tons.

Photograph by courtesy of the builders, Vickers-Armstrongs (Shipbuilders) Ltd.

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level. Against this, calcium-nickel-phosphate benefits from higher yields.

With both catalyst systems, cyclic operation is required, in which the dehydrogenation phase is followed by regeneration. The length of the make period may be increased by reducing conversion taken per pass or by raising the steam-hydrocarbon ratio.

The controlling variables—temperature, steam-hydrocarbon ratio, and conversion per pass (adjusted by contact time)—are set upon consideration of economic aspects, including cost of steam, butenes, required output, etc. Furthermore, temperature level is determined by catalyst activity, and is increased with catalyst age.

Illustrative of conditions over Catalyst 1707 is a conversion of 25% to 35% per pass, operating temperature of 1,150 F to 1,250 F, 500-hour^{-1} butene space velocity, and 10 volumes steam per volume of feed hydrocarbon. Total pressure is substantially atmospheric (approximately 5 to 10 psig at reactor outlet). Useful yield at these conditions is 80% to 85% of theory.

Quite different operating conditions are called for with calcium-nickel-phosphate catalyst. Typically, butene space velocity is 90 to 100 hours^{-1}, and minimum steam-hydrocarbon ratio is 18.1. The catalyst is started at 525 C, but is gradually raised to about 630 C for a conversion of 30% per pass. Obtainable yield with this catalyst is 92% to 94% of theory.

This catalyst must be regenerated after 30 to 60 min onstream. An air-stream mixture is used for the regeneration step, and peak temperature is held to 675 C.

2. *Single-Stage Butane Dehydrogenation:* The single-step process, which is today in commercial use for conversion of butane to butadiene, was developed by Houdry Process Corp. Its catalyst is activated alumina impregnated with 18% to 20% chromic oxide. Activity of this catalyst is impaired by water. It is not, therefore, possible to use steam as diluent. Instead, the reactor is operated at low pressure (5 in. Hg abs. for butadiene production).

Feed to the reactor is a mixture of about two-third n-butane and one-third n-butenes. The latter are obtained in the recycle gas which contains some 42% butenes. Dehydrogenation temperature is 1,100 F to 1,150 F, and liquid space velocity is of the order of 1.0 to 1.5 hours^{-1}.

The single-stage process is characterized by low yield—only about 56% of fresh butane feed is converted to butadiene. Most of the remainder appears as coke (14%) and light hydrocarbons.

Most of the coke deposits on the catalyst, and is burned during the regeneration period. Enough heat is evolved thereby to supply the endothermic requirements of reaction. The principle of heat transfer is recuperative; i.e., during the regeneration, the catalyst and reactor case are raised to 1,150 F; during the make period, the catalyst gives up sensible heat to the (preheated) process stream until its temperature has dropped to 1,100 F.

Operation is cyclic. Onstream time is between 7 min and 10 min. A vacuum purge follows this period. Preheated air is then introduced to effect regeneration. Total cycle time is 20 min to 25 min.

The reactor make is passed to a tower, where it is quenched with oil. Heat from the circulating oil stream is taken up in an external waste-heat boiler, so that this process is a net producer of steam.

The quenched process gas passes through a knockout drum, and is compressed to the pressure of the butadiene recovery stage.

3. *Purification of Butadiene:* Butadiene is usually required in 95% to 98% purity. The reactor make contains, however, barely 30% of the diene in the two-stage process, and 11% in the single-stage process.

The first stages of recovery are conventional, consisting usually of an oil absorber which takes up C_5 and heavier cuts and a depropanizer, leaving essentially a C_4 fraction.

Standard fractionation is adequate for the removal of relatively high-boiling 2-butenes and n-butane. This approach is not, however, adequate to separate butadiene from close-boiling 1-butene.

The final purification step is effected commercially by one of two methods: extractive distillation in the presence of furfural, and absorption in cuprous-ammonium acetate.

Purification of butadiene by extractive distillation calls for a column of about 100 plates. The hydrocarbon mixture is fed near mid-point and furfural near the column top. Butene is taken overhead. A butadiene-furfural solution is withdrawn as bottoms, and is separated in a final 20-plate column.

The absorption method of butadiene purification is of interest principally where the feed gas is relatively dilute. Its main application is in the recovery of butadiene from the tail gas in polymerization plants.

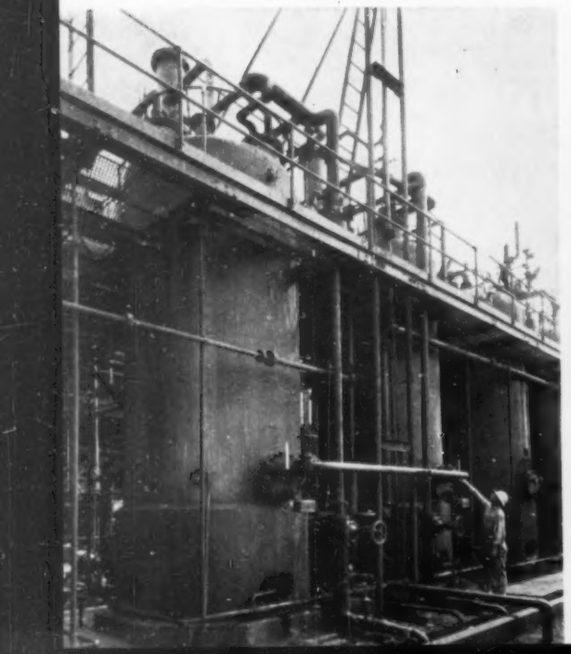
The scrubbing medium in this process is an eqeous solution of cuprous-ammonium acetate with which butadiene forms a soluble complex, while other hydrocarbons remain in gaseous form. The butadiene-rich solution is heated for decomposition of the complex and recovery of butadiene.

Production of Styrene: There are two fundamentally different processes for the production of styrene, both of which employ ethyl benzene as starting material.

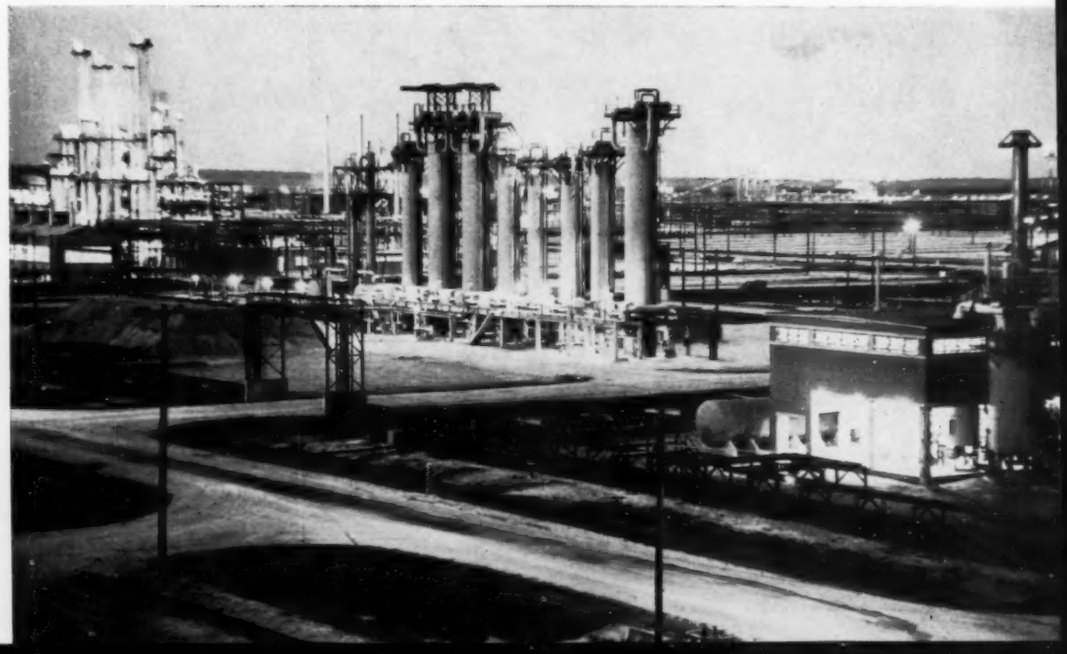
This intermediate is recoverable directly from a number of petroleum fractions. Among these, the most suitable feed is the C_8 cut of catalytic reformate, which normally contains between 8% and 20% ethyl benzene. Actually, this direct method of ethyl benzene recovery is used by only one styrene producer, viz., Cosden Petroleum Co., which purifies the desired hydrocarbon by fractionation in three 200-ft towers.

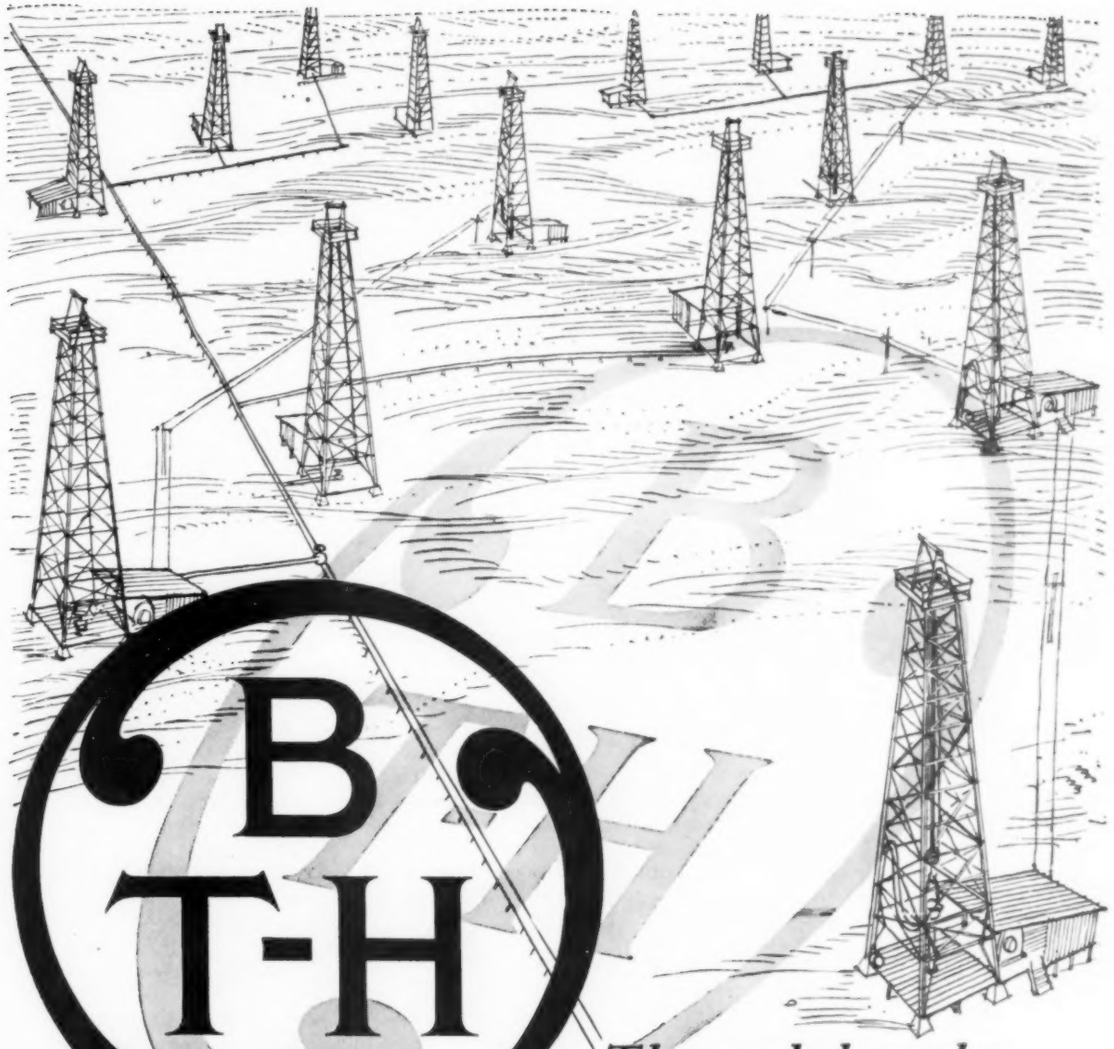
All other producers of styrene obtain their ethyl benzene by alkylation of benzene. A discussion of commercial styrene synthesis, therefore, consists of two distinct parts: (1) ethylation of benzene, and (2) conversion of ethyl benzene to styrene.

Reactors for the Partial Oxidation of Ethyl Benzene (photo, courtesy Carbide & Carbon Chemicals Co.).



View of Dow Chemical Co.'s Styrene Plant, at Freeport, Texas (photo, courtesy Dow Chemical Co.).





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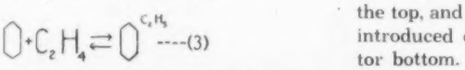
1. *Ethylation of Benzene:* Two processes are employed commercially to effect the reaction of ethylene with benzene:



Commercially predominant is the liquid-phase process in which anhydrous aluminum chloride serves as catalyst. In addition, Koppers Co. operates a 120-million-pound-per-year ethyl benzene plant at Kobuta, where the ethylation is carried out in the vapor phase over a fixed-bed catalyst, stated to be alumina on silica gel[1].

At normal reaction conditions, the reaction equilibrium is strongly in favor of ethyl benzene formation, and ethylene disappearance is greater than 99%. Byproduct formation occurs principally due to reaction of ethylene with the desired product to yield polyethylene benzenes and some butyl benzene.

In the *liquid-phase process*, the reaction is carried out in vertical cylindrical towers, usually of acid-brick construction. These alkylators are filled with a mixture of benzene and its various alkylation products through which the catalytic aluminum chloride-hydrocarbon complex is dispersed. For best catalyst efficiency, the presence of a small amount of hydrogen chloride is required. This promoter is introduced most conveniently in the form of ethyl chloride.

Nitration-grade benzene is a satisfactory feed stock. Its sulfur and paraffin content should be low. Sulfur is objectionable because it increases catalyst consumption; paraffins are undesirable because they build up in the benzene recycle.

Ethylene concentration is not very critical, but the presence of sulfur compounds, higher olefins, acetylene, and water is objectionable. To achieve maximum throughput per unit converter space, ethylene concentration above 94% is desirable.

Polyethyl benzenes, which are formed as co-products in the process, are recycled to the converter where they undergo an equilibration reaction with benzene which will yield ethyl benzene. This reaction is much slower than the reaction of ethylene with benzene, and the size of the alkylator is determined principally by this rate-controlling dealkylation. Nevertheless, such recycling of polyethyl benzene is necessary so that contained benzene and ethylene values may be recovered.

Ethyl benzene formation is favored over polyethyl benzene production by using a low ratio of ethylene to benzene. We shall see below that this aspect is quite critical in the vapor-phase process. In liquid-phase alkylation, on the other hand, polyethyl benzenes are recycled to the reactor in any event. For practical purposes, the optimum operating ratio of all ethyl groups to benzene rings introduced into the liquid-phase alkylator is found to be in the range 0.55 to 0.65.

A typical reactor feed will contain 1,000 parts by weight of benzene, 250 parts polyethyl benzene, and 160 parts ethylene. At several plants, the entire feed is introduced at the reactor bottom. At others (e.g., Koppers' Port Arthur plant), benzene, polyethyl benzene, and makeup catalyst are fed at the top, and ethylene plus ethyl chloride are introduced countercurrently at the alkylator bottom.

Operation is at slightly superatmospheric pressure, and at 90 C to 100 C. The exothermic heat of reaction (approximately 27 Kcal per gram-mole) is removed by vaporizing benzene and some EB which is refluxed from an overhead condenser. Residence time in the reactor is 3 to 5 hours.

The liquid reactor effluent is cooled to 60 C, and taken to a settling tank in which the catalyst complex is separated. All but a small bleed stream of this phase is returned to the alkylator.

The hydrocarbon phase is washed and neutralized, and is then taken to a series of fractionation columns in which benzene, ethyl benzene, and light polyethylbenzenes are isolated. Benzene is dried and recycled. The light polyethyl benzenes are returned to the alkylator feed directly. Ethyl benzene, the main product, is withdrawn to storage. The requirements of the styrene process set a maximum limitation of 0.02% on its permissible diethyl benzene content.

Heavy polyethyl benzenes and spent catalyst complex may be discarded or forwarded to a high-temperature dealkylation stage which is operated for the partial recovery of useful products.

In the liquid-phase ethyl benzene process, efficiency of 94% to 96% on benzene and 95% to 97% on ethylene is attained. Aluminum-chloride consumption ranges from 1 lb to 3 lb per 100 lb of ethyl benzene, depending chiefly on sulfur and moisture content of feed stocks.

Vapor-phase alkylation, the alternate commercial process for ethyl benzene synthesis, calls for operation at elevated pressure. The principal catalysts useful for this operation are typified by the system alumina-silica and by phosphoric acid on a suitable carrier (e.g., Kieselguhr).

The production of ethyl benzene is unavoidably accompanied by the formation of polyethyl benzenes. In the liquid-phase process, the bulk of these byproducts is recycled to the reactor for dealkylation. Such recycling is not feasible in the vapor phase process. Instead, conditions are chosen which will minimize polyethyl benzene formation.

The ratio of benzene to ethylene is the most important single variable which determines the extent of polyethyl benzene formation. Polyethyl benzene content of alkylate can be reduced to 10% from 15% by boosting the benzene-ethylene ratio to 12 from 8 at otherwise comparable conditions. Obviously, the use of high benzene ratio imposes a severe burden on the benzene-recovery column which follows the alkylation stage. Cost of distillation, as well as considerations of throughput requirements, sets a practical upper limit on the feed ratio.

High pressure and temperature are required to obtain satisfactory conversion at commercially practical space velocities. At the Kobuta plant, inlet conditions to the catalyst cases average 900 psig and 310 C[1]. The converters are operated adiabetically, so that the temperature of the process stream is increased toward the outlet.

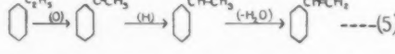
The alkylation catalyst is gradually fouled. To offset the resulting loss in activity, it is necessary to raise the temperature gradually, and this is accompanied by greater polyethyl benzene formation. This phenomenon, as well as plugging of the catalyst bed which is caused by deposition of carbonaceous material, limits the useful onstream life of a catalyst batch to 70 to 100 days, depending on the nature and amount of impurities in the feed streams. Regeneration of alkylation catalyst is not practiced, but its life may be extended somewhat by reversing the direction of the process stream toward the end of the cycle.

The converter effluent is condensed and cooled, and is fractionated for the recovery of recycle benzene, product ethyl benzene, and byproduct polyethyl benzene which may be dealkylated by the $AlCl_3$- catalyzed reaction with benzene in an auxiliary liquid-phase reactor.

For the liquid-phase process, Garner[1] lists the following advantages over synthesis of ethyl benzene in the vapor phase: ability to dealkylate polyethyl benzene, lower benzene-to-ethylene ratio, use of low-pressure equipment, greater flexibility in feed ratio, absence of butyl benzene from the alkylate. On the debit side, the liquid-phase process suffers from corrosive conditions, higher catalyst cost per unit product, possible emulsion formation during neutralization, a greater waste-disposal problem, and reaction sensitivity to moisture.

2. *Conversion of Ethyl Benzene to Styrene:* By far the most important route for conversion of ethyl benzene to styrene calls for direct dehydrogenation:

This method is employed at all but one styrene plant. The lone exception is an installation operated by Carbide and Carbon Chemical Co., at Institute, W. Va., where a three-stop process is practiced:



Carbide's process was developed at a time when styrene purification difficulties threatened to defeat direct dehydrogenation. This method continues to be commercially attractive, largely because of sales of byproduct acetophenone.

The *dehydrogenation of ethyl benzene* (equation 4) is carried out catalytically and in the vapor phase. In American practice, catalysts based on magnesium oxide or iron oxide are preferred. In a somewhat similar German styrene process, dehydrogenation is carried out over zinc oxide promoted by alumina and chromates.

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Formation of styrene is favorably influenced by operating at low partial pressure of reactants. In universal practice, steam is employed as diluent. This results not only in improved styrene yield, but also provides continuous self-regeneration of catalyst. Useful onstream life of catalyst is one to 1.5 years.

The diluent steam is introduced into the reactor with sufficient superheat to provide the entire heat requirements of the endothermic dehydrogenation system. Typically, 2.6 lb steam per pound of ethyl benzene is used. All but about 10% of the steam is superheated to 710 C and introduced singly into the reactor. The remainder is premixed with ethyl-benzene feed, and this mixture is preheated to 520 C.

Styrene yield is influenced most significantly by the conversion taken per pass, a dependent variable adjusted by control of temperature and residence time. Operation with steam dilution over a self-regenerating catalyst gave 91.5% yield at 30% conversion. At 40% conversion, the efficiency was reduced to 87.5%, while a further boost to 50% conversion lowered yield to an uneconomic 82.5%[2]. Normally, conversion is held between 35% and 40%.

The effect of temperature has been shown[3] to be without effect on yield up to about 635 C. Above this level, decomposition reactions lead to rapid decline in useful product formation. In commercial practice, the converter is operated at an average temperature of about 600 C. Since the entire heat of reaction is supplied by the incoming feed-stream mixture, a temperature drop of 60 C to 70 C occurs between converter inlet and outlet.

Space velocity is adjusted to control the desired degree of conversion. Within the range employed commercially, increasing space velocity lowers conversion. It should be noted, however, that variations in space velocity cease to be significant above an LHSV of approximately 4.

The reactor effluent is cooled in several stages. Tars are removed just above 100 C, for their continued presence in subsequent coolers would lead to excessive foaming difficulties. Further cooling will condense water, styrene, unconverted ethyl benzene, and other medium-boiling products. Following gravity separation, the hydrocarbon phase is forwarded to the distillation stage.

The crude product at this point contains some 37% to 40% styrene. Most of the remainder is ethyl benzene, which must be recycle. In addition, there is some benzene and toluene, plus other light boilers which are readily topped off. The topped crude product is taken to the main columns in which ethyl benzene is removed overhead and styrene concentrated as bottoms.

These two components boil within a close range (9 C spread at atmospheric pressure). The problem of their separation is compounded because of styrene's strong polymerization tendency at elevated temperature.

To overcome these difficulties, it is necessary to carry out the fractionation at high vacuum and in the presence of an inhibitor. Furthermore, the columns must be designed so as to provide only short holdup time for styrene in the liquid phase.

The commercial separation of styrene from ethyl benzene calls for about 70 actual plates. Even with a moderate pressure drop per plate, the bottoms temperature in such a column would be so high that excessive polymerization will occur. It is, therefore, common practice to carry out the fractionation in two columns in series—each with its own vacuum system. By holding the top pressure in these split fractionators at 35 mm Hg, bottoms temperature can be maintained at 90 C.

This still temperature becomes permissible when an inhibitor is fed to the system. Most commonly, sulfur is added for this purpose, but other inhibitors are suitable and hydroquinone is used by at least one USA producer.

Styrene, withdrawn from the ethyl benzene column, must be subjected to a finishing distillation, mainly to free it from sulfur (or hydroquinone). This final, relatively simple topping step is also a vacuum operation. Here, too, an inhibitor must be provided in the upper portion of the column. This purpose is accomplished by the addition of tert-butyl catechol, in low concentration (10 ppm). The same inhibitor serves to protect product styrene from polymerization in storage.

The *indirect method of styrene synthesis* (equation 5) was developed principally because it sidesteps the difficulties of separation from ethyl benzene.

The first step in this process is the oxidation of ethyl benzene to acetophenone. In this reaction, air is the oxidizing agent, and manganese acetate serves as catalyst. The reaction is carried out in the liquid phase at 125 C. Operating pressure is 30 psig, and contact time has been reported at 1.5 hours.

Some details of this operation at Carbide's Institute, W. Va., plant have been made available[4]. The reaction is carried out in acid brick-lined converters provided with stainless-steel cooling coils. Two converters are employed in series. In the first of these, about 16% of the ethyl benzene feed is converted. In the second (identical) reactor, another 10% of the initial ethyl benzene is converted. This two-stage approach is preferred because conversion rate slows down markedly as the reaction proceeds.

The effluent from the second converter contains approximately 73% ethyl benzene, 17% acetophenone, 8% phenyl methyl carbinol, and 2% byproducts. It is washed and partly neutralized—maintaining a slightly acid condition.

The organic mixture is then taken to a vacuum distillation in which ethyl benzene is removed overhead. A second distillation, carried out at 14 mm Hg abs., serves to separate a 68% acetophenone—32% phenyl methyl carbinol mixture from higher-boiling byproducts. This mixture is taken directly to the hydrogenation stage.

In this second step of the process, acetophenone is converted to phenyl methyl carbinol. Gaseous hydrogen is the reducing agent. The reaction is carried out in the liquid phase.

A number of catalysts have been reported effective in this hydrogenation. Guest and McNamee[5] report good performance with iron-copper-chromium catalyst, suspended in the reaction medium in 4% to 10% by weight of concentration. Hydrogen pressure is 100 to 200 psi, and operating temperature is 130 C to 175 C.

The reduction of acetophenone to phenyl methyl carbinol is unavoidably accompanied by some ethyl benzene formation. Extent of this byproduct formation is directly related to completeness of the main reaction. Guest[5] cites conditions at which the product contains 5.4% acetophenone, and ethyl benzene formation is 4.7%.

The converter effluent is separated from the accompanying gas phase. The liquid stream is then filtered for the removal of catalyst, which is recycled to the reactors.

The crude product is topped for the recovery of ethyl benzene, which is returned to the oxidation stage. A vacuum distillation serves to separate phenyl methyl carbinol (plus contained acetophenone) from associated impurities.

The final step in the indirect route to styrene calls for dehydration of phenyl methyl carbinol. In a process due to Shriver[6], the conversion is carried out in the vapor phase at approximately 250 C. Titanium oxide, on an alumina carrier, serves as fixed-bed catalyst.

Conversion of about 80% is taken per pass. This results in a 91% yield. Side reactions are confined to the formation of high-boiling impurities, from which styrene is removed with ease by vacuum distillation.

As we have noted above, the feed to the dehydration converter contains some acetophenone. This compound passes through unaffected. Together with unconverted carbinol, it is recycled to the hydrogenation step.

Overall styrene yield in the indirect process is 80% to 82% (on ethyl benzene). This compares with an efficiency of 86% to 87% obtained in the direct dehydrogenation process. Partly offsetting the poorer utilization is the value of acetophenone, which is recoverable at an intermediate stage of Carbide's three-stage process. The market for this byproduct is, however, quite limited, and can hardly support another plant using the indirect method of styrene synthesis.

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PROGRESS IN WELL-COMPLETION METHODS

PART III—
Increasing permeability of formations about producing wells

by Lester C. Uren*

EARLIER articles in this series have been concerned primarily with techniques designed to develop and maintain conditions favorable for efficient production of oil and gas within and at the wall of the well. In addition to these essential conditions, there is another factor essential for efficient production which is concerned with the reservoir rock itself, beyond the wall of the well. For efficient production, the reservoir rock in the vicinity of the well must be sufficiently permeable to pass oil and gas through its pore spaces without excessive flow resistance. Modern well-completion techniques now seek to increase the natural permeability of the reservoir rock about the well by artificial means. The methods employed involve use of acid to dissolve a portion of the reservoir rock—thus enlarging its drainage channels; application of explosives or hydraulic pressure to develop fractures in the reservoir rock; and injection of chemical reagents into the pore spaces of the reservoir rock so that there will be an increase in its relative permeability to oil in preference to water.

Before undertaking a brief description of these permeability-increasing techniques, the reader is again reminded that oil reservoir rocks are seldom if ever uniform in their lithologic properties: that their texture, permeability, and porosity commonly vary both vertically and laterally; that the reservoir strata are often irregular in thickness and lacking in continuity. Secondary "stringers" of impermeable calcite or silica, deposited in thin fractures, sometimes cut across the bedding planes—thus effectively restricting free drainage of fluids. Uniformity and regularity in these matters are unusual and, as a result, drainage of fluids through the reservoir rock is primarily through the more permeable channels which are often circuitous in their approach to the wells. In most sedimentary formations, the permeability is much greater along the bedding planes than across the bedding planes. It is well to remember, also, that reservoir rocks may be either calcareous or siliceous in character. Some are hard and brittle, while others are relatively soft and pliable. Therefore, they differ markedly in their response to methods of increasing permeability.

Acid treatment of carbonate reservoir rocks: Many of the world's important oil and gas fields produce from limestone and dolomitic reservoir rocks—sometimes in massive form, in other cases composed of carbonate sands or siliceous sands with calcareous cementing material. The carbonate minerals are freely soluble in hydrochloric acid and, by forcing acid through the wall of the well and into the pore spaces of the surrounding reservoir rock, some of the rock walls of the drainage channels and mineral grain cementing material will be dissolved—thus increasing the rock permeability.

Hydrochloric acid of about 15% concentration is generally used. Ordinary commercial hydrochloric acid has a concentration of from 28% to 35% HCl; hence, for use in wells, it is diluted with one to two parts of water. To this is added an inhibitor which protects casing, tubing, and other metallic equipment with which it may come into contact, against corrosive action. A surface-active reagent may also be added to assist the acid in displacing oil and water from the mineral surfaces; and, to restrict emulsion-forming tendencies, a demulsifying agent may also be added.

Forty-two gallons (1 bbl) of 15% hydrochloric acid is capable of dissolving about 0.4 cu ft of average limestone, but this varies considerably with the character of the reservoir rock. The concentration of the acid used will also be varied somewhat with the character of the reservoir rock, and the most advantageous concentration should be determined by actual laboratory tests on core samples taken during the course of drilling. Dolomitic limestones require an intensified acid of higher-than-normal HCl concentration, to which a catalytic agent is added to hasten the reaction. On the other hand, for some operations where considerable time is needed to force the acid into the more remote recesses of the reservoir rock, a retarding agent or a more dilute acid may be used.

The prepared acid is brought to the well in tank trucks, and pumped down the well under pump pressure through a column of auxiliary tubing on the lower end of which a packer may be placed to confine the acid to the well interval to be treated. The amount of acid used in a single treatment will vary from as little as 250 gal to as much as 60,000 gal, averaging perhaps, 1,000 gal. Several thousand pounds per square inch pressure is sometimes needed to force the acid into the pore spaces of the reservoir rock; and, for this purpose, heavy-duty reciprocating pumps are brought to the well on especially equipped motor trucks. Acid treatment of wells is customarily done under contract by service organizations which furnish the acid and bring to the well their specialized equipment and trained personnel. Careful planning and preliminary study and preparation of the well are necessary to assure success.

A preferred method of injecting the acid involves first filling the well with crude oil and then lowering a column of auxiliary

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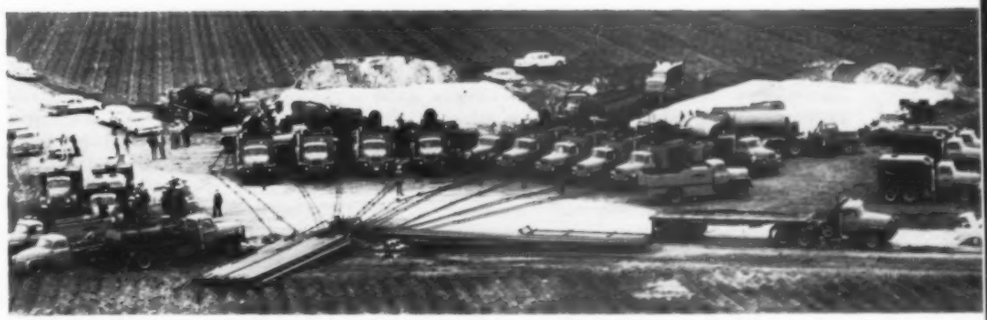
tubing equipped with a wall packer near its lower end which closes the well below the interval to be treated. Tubing-head connections are provided so that either oil or acid from nearby tanks or tank trucks can be forced down the tubing under pump pressure. The annulus between the tubing and casing is closed by a casinghead capable of withstanding high pump pressure, and valve controls are provided on side-outlet pipelines leading from the casinghead to a nearby tank where oil may be gauged. Acid is then pumped down through the tubing, in sufficient volume to fill the tubing and the annular space about it through the interval to be treated. Oil is meanwhile displaced from the well through the side outlets of the casinghead into the oil-gauging tank. The volume of oil displaced from the well is a measure of the acid pumped into the tubing. Valves on the side outlets at the casinghead are now closed, and high pump pressure is applied to the column of acid in the tubing. Either more acid or oil may be used as the displacing medium. Since the acid now cannot rise in the annular space about the tubing, it is forced out through the wall of the well into the adjacent formation. As the pump pressure builds up, more and more acid is displaced into the formation—filling its pore spaces and drainage channels. Under favorable conditions, it is believed that areas of reservoir rock many feet from the wall of the well will be reached by the injected acid.

When the desired volume of acid has been displaced from the well, surplus acid left in the well is forced back to the surface by reverse circulation—pumping oil down through the annular space and back to the surface through the tubing. Pump pressure is maintained during an interval of time sufficient for the acid to be neutralized by reaction with the carbonate mineral with which it is in contact. The time of treatment varies, depending upon conditions from one to as long as 72 hours. The chemical reaction between the acid and carbonate mineral produces carbon-dioxide gas and a water solution of calcium chloride. These fluids readily flow back into the well when pump pressure at the well head is relieved; and the residual products may then be circulated, bailed, or swabbed from the well.

Other methods of applying acid in treatment of wells may be used where special conditions are presented. In the less-soluble reservoir rocks, repeated application of acid may be advisable. It may be difficult to force acid into the less-permeable formations, even with high pump pressure; but the first application may open channels through which later applications will penetrate more deeply. In some situations, the acid may be jetted against the wall of the well through nozzles in the auxiliary tubing. Erosive action created by hydraulic force may thus aid in penetrating the wall rock. Acid may be applied either in open hole or through casing perforations.

In many fields, the producing formation



Equipment employed in a 325,000-gal fracturing operation: Fresh water and sand were injected into this well at the rate of 71 bbl per min (photo, courtesy Dowell Incorporated).

Allison aircraft-powered pumping units used for high-injection-rate hydraulic fracturing: In background are 15,000-gal rubber tanks for fracturing fluid storage (Dowell photo).

Polyethylene film-lined surface storage pit used for temporary storage of fluid employed in hydraulic fracturing operations (Dowell photo).

Equipment employed in high-volume high-injection-rate hydraulic fracturing operation: Multiple lines lead from pumping units to well at left (Dowell photo).

consists of a series of strata which display considerable variation in permeability and the less-permeable strata may yield very little of their oil to the wells, though fully saturated. When the entire interval is subjected to acid treatment in a single operation, the acid tends to enter the more permeable, free-draining strata—leaving the less-permeable strata relatively uninfluenced. In applying acid to such a series of strata, it may be advisable to adopt procedures which will force most of the acid into the less-permeable beds and avoid injection of acid into the more-permeable beds which yield their oil freely without acid treatment. For such situations, methods may be employed in which the more-permeable strata are temporarily sealed off at the wall of the well so that the acid may not enter them when subsequently introduced.

Reagents are marketed and serviced to the industry, and these can be forced under pump pressure as liquids into the more-permeable strata exposed at the wall of the well. They then gel to form a semi-solid mass which again resumes liquid form after 24 to 36 hours. Meanwhile, the interval is subjected to high-pressure acid injection—the acid entering the less-permeable beds which have been little influenced by the sealing solution. Other reagents are effective in sealing water-bearing strata but do not influence oil-bearing strata. Wherever they come into contact with salt water, an adherent precipitate is formed which seals the water-bearing strata against contact with acid subsequently introduced.

Selective acidizing seeks to inject the acid only into certain strata or to inject different amounts into each of several strata: more acid into the less-permeable strata. Methods are available which permit of confining the acid to any desired interval in the well and of regulating the pumps to apply whatever pressure is necessary to assure injection of the required volume of acid into each of several strata, one at a time. In this procedure, two pumps are used: one forces acid down through a column of tubing extending into the interval to be treated, while the other forces oil down through the annulus about it. A bridging plug blocks off the lower part of the well below the treatment interval. A device called an "electric pilot," placed on the lower end of the tubing, indicates to an observer at the surface the position of the acid-oil interface in the well. The two pumps are regulated to maintain this level constant while the acid pump maintains sufficient pressure to force acid into the treatment interval at the desired rate.

The advantage gained by acidizing wells has been demonstrated by results in thousands of wells in many fields. Substantial increases in the rate of production are obtained under favorable conditions. Inasmuch as this results from increased permeability of the producing formations about the well, and since this favorable condition is likely to persist throughout the life of the well, it is reasonable to expect that increased ultimate recovery will be obtained.

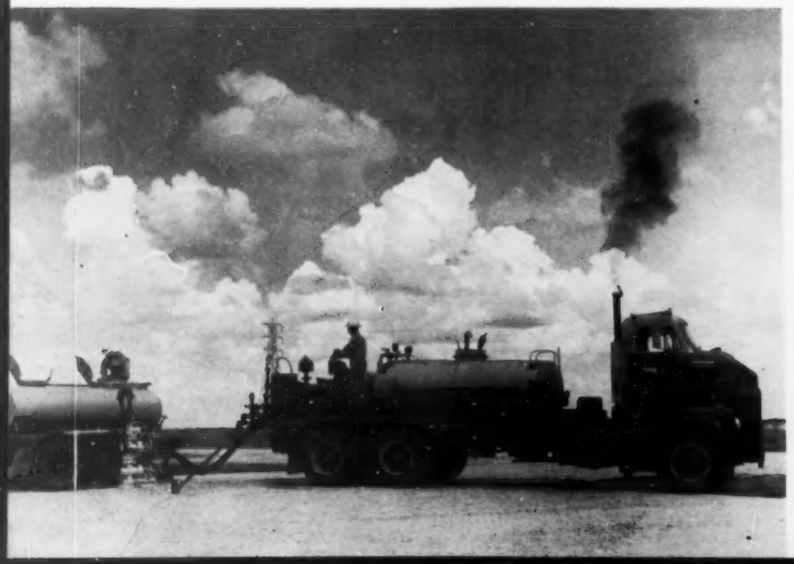
Increasing permeability by fracturing reservoir rocks about wells with the aid of explosives: In the preceding article of this series, the use of nitroglycerin was described as a means of forming cavities within the reservoir rock about producing wells. It was also explained that, in addition to forming well cavities, the explosive could be expected to create fractures in the formation which in many cases probably extend outward many feet from the walls of the wells. The harder limestone and sandstone reservoir rocks, in which explosives may be effectively used, are unable to adjust themselves to the severe lift and thrust of the explosion without cracking or separating along bedding and joint planes. Crumbling of the rock structure along these fractures probably results in fragments of the formation lodging in the fractures—thus preventing them from closing. Some authorities believe that, under favorable conditions, such fractures may extend for 50 ft or more from the well cavity. This has been proved in some instances where shot cavities have been subsequently exposed by mining operations which permitted actual observation and measurement of the cavities and fractured zones.

Shooting wells will stimulate production in most fields which produce from massive limestone and well-indurated sandstone reservoir rocks. Limestone strata may have satisfactory pore space for storage of oil, but low permeability due to lack of continuity of the porosity. In such cases, fractures formed by shooting wells may provide communicating channels for drainage from isolated bodies of oil which otherwise would not be produced. Similarly, small "stringers" of secondary calcite or silica, which cut across bedding planes and create barriers which prevent free drainage of fluids, may be fractured by the explosive force so that oil may drain across them. Some wells produce very little oil until they are shot, but then may flow substantial production for several days or weeks. How much of this is due to the formation of a cavity about the well, and how much to fracturing of the reservoir rock beyond the wall of the cavity, is impossible to determine.

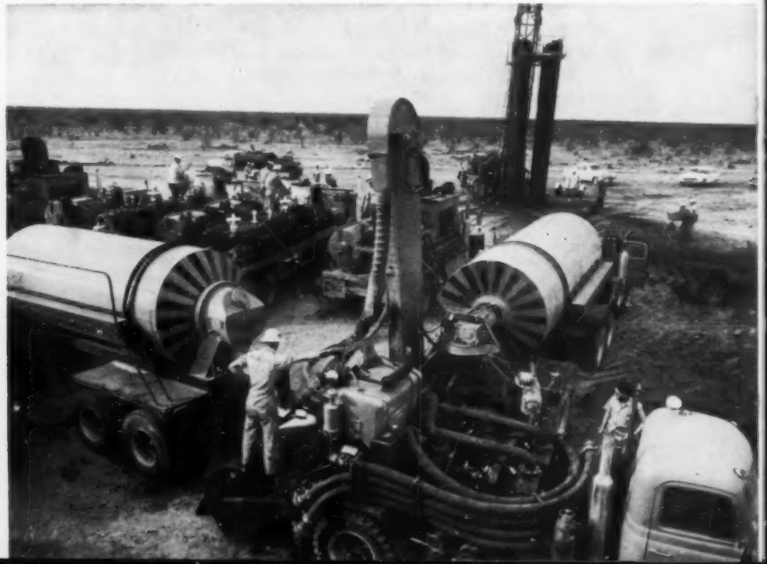
Increasing permeability by hydraulic fracturing of the reservoir rock in the vicinity of wells: One of the outstanding developments of the past decade in the oil-producing industry is known as "hydraulic fracturing." An outgrowth of research by technologists of Stanolind Oil and Gas Co., the method was first brought to the attention of the industry[17] in 1948. Since that time, upwards of 100,000 fracturing operations have been applied to something like one-fifth of all the producing oil and gas wells in the United States. About 75% of these operations have been successful in stimulating oil and gas production. As a result, many of the older fields have been given renewed life, and some newly discovered fields which would scarcely have been considered economic have become profitable producers.

Hydraulic fracturing involves the application of fluid pressure to the reservoir rock exposed in the wall of a well with the purpose of forming fractures which extend for many feet outward from the wall of the well into the surrounding oil and gas reservoir—thus creating new and larger channels through which oil and gas may drain

Equipment used in acidizing a flowing well—showing acid truck with high-pressure high-volume pump driven by 335-hp engine, and acid trailer (photo, courtesy Halliburton Oil Well Cementing Co.).



Equipment employed in a hydraulic fracturing operation: Sand conveyors and blending equipment are in foreground; pumping units in rear (Dowell photo).



to the recovery wells. Increased permeability of the reservoir rock, thus developed, permits drainage over greater areas and more effective recovery of oil and gas—not only increasing the rate of production, but assuring earlier and greater ultimate production.

The fluid used in hydraulic fracturing is generally a sand-laden oil which is forced down the well under high pump pressure and in considerable volume so that it may rapidly build up pressure against the wall of the well. The fluid enters the producing formation—opening drainage channels which begin at the wall of the well and extend outward; sometimes more or less horizontally along the bedding planes, sometimes vertically, cutting across the bedding planes. The sand suspended in the oil enters the fractures so formed, and prevents them from closing again when the fluid pressure is relieved. Thousands of gallons of oil and tons of sand are thus forced into the producing formation through fractures which are believed to extend over distances of several hundred feet under favorable conditions. The average hydraulic fracturing operation uses 500 gal to 1,000 gal of fluid and 500 to 2,000 lb of sand for each foot of formation exposed. Large-volume fracture jobs may use from 50,000 gal to 100,000 gal of fluid, but the average is perhaps 10,000 gal.

Service organizations undertaking this work bring to the well their trained personnel and specialized equipment mounted on motor trucks. Fracturing fluids and sand are brought to the well in tank trucks. Especially designed blending equipment mixes the oil and sand in the desired proportion, and high-duty engine-driven pumps force the oil-sand mixture down the well. The fluid pressure may be applied to the treatment interval in the well, either in open hole or through casing perforations; and the fluid may be pumped directly down the casing or through an auxiliary string of tubing packed off against the casing or the wall of the well to confine the fluid to the treatment interval. Not more than 50 ft of producing formation should be subjected to treatment in one operation.

A variety of different fluids has been used for fracturing purposes. The fluid should be sufficiently viscous to keep sand in suspension, yet not so viscous as to increase friction losses and pumping pressures unduly. It should be sufficiently fluid to penetrate the fractures formed, yet not be absorbed too rapidly by the surrounding formations. Rapid leaking of fluid into the formation may make it difficult to develop sufficient pressure for effective fracturing. Also, the fluid employed should be compatible with the reservoir fluids, and remain sufficiently fluid to drain back into the well after the operation is completed and the well is placed on production. Formation of emulsions with connate water in the reservoir, or segregation of gummy asphaltenes which may clog the drainage channels, must be avoided.

In early fracturing operations, kerosine or diesel oil were used as fracturing fluids, to which thickening or viscosity-increasing agents were added. More recently, crude oil from the formation under treatment has been used in many cases. Chemical additives which form gels, and surfactants to promote intimate contact of the fluid with the mineral surfaces, are effective in developing desirable properties. In some cases, nonperforating fluids are deliberately sought as a means of promoting vertical fractures in the formation about the wall of the well. For gas and water wells, water may be used as the fracturing fluid—perhaps with the addition of chemical reagents to increase viscosity, prevent formation of emulsions, and promote wetting properties.

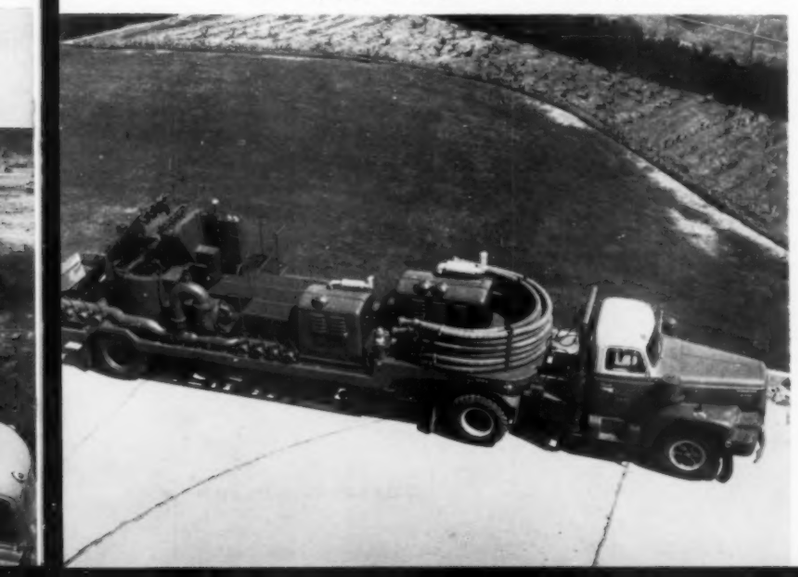
Hydraulic fracturing may be combined with acid treatment in carbonate reservoir rocks, by using hydrochloric acid emulsified with oil as a fracturing fluid.[34] Fractures are formed, and the emulsified acid with sand in suspension enters the fractures. The acid reaction is slower than normal because of its emulsified condition—permitting it to reach out into the smaller and more remote fractures before the acid is neutralized. The acid attacks the walls of the fractures—enlarging them; and the emulsion disintegrates so that the spent acid and oil may drain back into the well.

The sand used should be screened, usually to 20- to 40-mesh in size, and the sand grains should preferably be rounded rather than angular. From 1 lb to 4 lb of sand are used per gallon of fracturing fluid. Starting with 1 lb per gal, the amount of sand may gradually be increased as the operation progresses.

The pump pressure necessary to start a fracture varies greatly, depending upon several factors—ranging from a few hundred pounds per square inch up to 10,000 psi or more in the deeper, less-permeable formations. Usually the initial "breakdown" pressure necessary to start a fracture is considerably greater than that necessary to extend it after it is started. For lowest breakdown pressures, it is important that the walls of the well and the casing perforations be free of adherent clay. The rate at which the injection fluid can be handled by the pumps is also important in developing the necessarily high initial injection pressures. As much as 75 bbl of fluid per minute can be pumped through 5½-in. casing in wells 8,000 ft to 10,000 ft deep—averaging perhaps 40 bbl per minute. If the fluid is injected through smaller auxiliary tubing which offers more resistance, 10 bbl per min is about the maximum which can be forced through the tubing—averaging 3 to 5 bbl per min. To handle such volumes of fluid at pressures which may range as high as 10,000 psi, pumping units must be designed to deliver as much as 700 hydraulic horsepower.

It is difficult to predict just how a particular well will respond to hydraulic fracturing, or to know with certainty the extent and orientation of the fractures which are formed. However, theoretical studies, research, and field experience indicate that the harder, more brittle formations fracture best; while the softer shales and clays behave as plastics, and do not fracture satisfactorily. Sedimentary formations usually have native "partings," bedding or joint planes, or more permeable strata which constitute planes of weakness where fractures will most likely form. Structural conditions involving folding and faulting of

Sand-proportioning equipment used in hydraulic fracturing operations: Capacity, 70 bbl per min (Halliburton photo).



Equipment employed in high-pressure acid treatment of a nearly completed well (Dowell photo).

formations may also determine the course of artificial fractures.

To form fractures along bedding planes, it would appear that the fracturing fluid must actually lift the overburden slightly, and this would require a fluid pressure of something in excess of 1 psi per ft of depth below the surface. However, it is known that fracturing often occurs at lesser pressures—averaging perhaps 0.7 of the calculated weight of the overburden; this can only be explained on the theory that formations within or overlying the oil and gas reservoir are compressible in some degree, or that they develop a natural arching effect which supports a part of the weight of the overlying formations. The fractured area, in some cases, may be pictured as a circular or elliptical "pancake" with the well at its center.

Some authorities believe that most of the fractures formed at other than shallow depths tend to be vertical rather than horizontal—cutting across, rather than along, the bedding planes.[30] Pressure developed at the wall of the well, it is reasoned, develops a tangential force capable of actually rupturing the wall rocks, just as a pipe will burst under excessive internal pressure; and such fractures would tend to be vertical.

It seems likely that the nature of the wall rocks and the fracturing fluid employed will also determine to some extent the orientation of fractures. If the formation is of low permeability, or if a highly viscous fluid is used which does not penetrate the wall rocks to any great extent, vertical fractures will be formed. On the other hand, if the formations are highly permeable and a low-viscosity penetrating-type of fluid is used, the fluid will enter the formation, progress along the bedding planes, and develop upward pressure which will cause horizontal fracturing. In general, the fractures formed will tend to be approximately perpendicular to the axis of least stress. Unfortunately, it is usually impossible to estimate with any certainty stress conditions in a deeply buried sedimentary formation, but it is reasonable to assume that native planes of weakness in the strata will generally determine where the fractures will be formed. In many instances, it is probable that the fracturing fluid does little more than overcome confining stresses to widen and extend existing native fractures.

Multiple Fracturing: A single application of the fracturing process may result in opening only one fracture along a plane of weakness which first responds to the fluid pressure. This may leave much of the producing formation uninfluenced. Multiple fracturing contemplates repeated application of the process in such a way as to create fractures in several or many different formation intervals, with the purpose of promoting more complete drainage of the reservoir.[18] To accomplish this, it is necessary to confine the rupturing force to a relatively small formational interval with the aid of straddle packers on the injection tubing—shifting the packers up or down the well with each successive application. The fluid may be applied through gun perforations in the casing—thus exerting maximum stress in the formation between the packers.

A novel method for temporarily closing casing perforations, through which the fracturing fluid has previously been applied, involves pumping down small rubber balls which come to rest against the perforations —thus shielding the interval in which they are used from subsequent fracturing operations.[33] When flow is reversed through the perforations after all fracturing operations have been completed, the rubber balls fall to the bottom of the well and may be retrieved, if desired, by bailing or by circulation methods.

In open hole, multiple fracturing may involve application of successively higher pressures to the formation—temporarily sealing the fractures formed at the wall of the well after each pressure application with a chemical reagent carrying suspended solids. This procedure may be repeated any number of times, after which the sealing agent is liquefied by further chemical treatment so that it flows back into the well—thus opening all fractures for drainage.

Causes of failure in hydraulic fracturing: Not all hydraulic fracturing operations are successful. The conditions presented in each well must be studied carefully to determine whether they offer promise of a successful result and, if so, how the operation may best be conducted to assure its success. It may be found that the necessary breakdown pressure is so high that an effective result cannot be obtained with the equipment available. On the other hand, the permeability of some part of the producing formation may be so high that the fracturing fluid will be drained away so rapidly that an effective pressure cannot be developed. Perhaps the strata fractured are barren, or yield so little oil that the operation is unprofitable; or, even if a satisfactory initial production is obtained, it may quickly decline after the injected fluid has been recovered. Sometimes the fractures formed admit top or bottom water to the oil-bearing formation, so that the percentage of water in the production of the well is greatly increased; or the fractures may intersect a gas cap—thus releasing large amounts of gas to the well which might better be preserved in the structure for future use in oil production. Dependable well logs and intelligent control of fracturing operations will reduce the likelihood of such occurrences.

Hydraulic fracturing is a comparatively new method of stimulating oil production and the techniques employed are still under development. B-J Service, Inc., of Long Beach, Calif., has recently offered to the industry, on a commercial basis, a new device called the "Frac-Assist" tool, which is designed greatly to increase the hydraulic pressure that can be applied to the formation to be fractured. Normal fracturing procedures are followed to develop fluid pressure against the formation from surface pumps. The Frac-Assist device, which is located in the well tubing immediately above the perforations, contains a solid rocket-propellent fuel. This is ignited by a "go-devil" which is pumped down from the surface with the fracturing fluid, detonating blank cartridges which ignite the solid fuel. The resulting gases of combustion develop a rapid increase in pressure in the well fluid, which is applied to the formation through the tubing perforations, creating a super fracturing force. It is believed that this device may be useful in situations where it is difficult to develop hydraulic force from surface equipment sufficient to accomplish the desired fracturing of the reservoir rock.

Another device, promoted by the Western Co. of Midland, Texas, is designed to control the position and direction of fractures by firing a series of shaped charges, supported in the well in such a way that a series of equally-spaced parallel holes are formed in the wall of the well at the depth where fracturing is desired. These holes, three in each of two opposite sides of the wall of the well, create a plane of weakness in the formation which assures parting at that depth and in the direction of the plane—usually horizontal—thus established. Normal fracturing procedures are applied to the well after the plane of weakness has been created. The Fracture Initiation Device is available to the industry through a service organization.

Increasing relative permeability for oil of reservoir rocks about wells: Reservoir strata in the vicinity of walls of wells tend to become water-wet as a result of absorption of water from drilling fluid and also, during producing operations, by accumulation of connate water. "Water blocks" so formed, may seriously restrict access of oil to the wells, especially in low-pressure formations. Water-wet formations will freely pass water through their pore spaces, but offer greater resistance to the passage of oil. On the other hand, oil-wet formations will freely pass oil, but will resist passage of water.

Chemical reagents are available which, when injected in oil solution into the reservoir rock through the pore spaces exposed in the walls of wells, tend to replace water on the mineral surfaces—rendering them oil-wet rather than water-wet. The relative permeability to oil is thus increased. Certain nitrogenous compounds will render reservoir rocks hydrophobic (water-repellent) for long periods of time, and thus promote production of oil by the nearby wells. Other reagents, including certain beef-tallow products, tend to make the reservoir rock surfaces water-wet (hydrophilic), and thus may advantageously be used in treating the wall rocks of wells to be used for water-injection purposes, as in water-flooding operations. A small concen-

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tration of ethylene-oxide condensation products in the injected flood water has been found to be effective in releasing asphaltic crude petroleum from adhesive retention on mineral surfaces—thus increasing formation permeability.

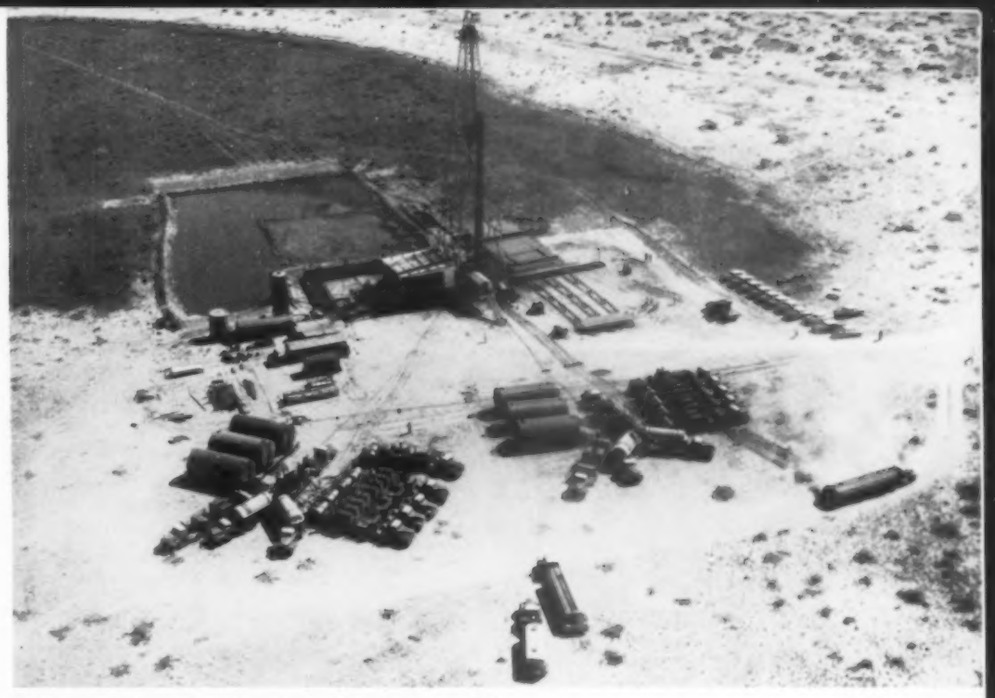
"Surfactants," a term applied to reagents used for the purpose of influencing the interfacial-tension relationships between oil, water, and mineral surfaces, are finding increasing application in conditioning reservoir rocks for greater efficiency in oil production. All, in one way or another, influence the relative permeabilities of the formation about the walls of wells to oil and water.

Choice of well-completion methods: With such a variety of methods of promoting oil-production efficiency to choose from, the operator is confronted with the problem of deciding upon a program of well completion which will yield best results under the conditions presented. This involves careful consideration of the character of the reservoir rock, the nature of the fluids contained within it, and the expulsive forces operative. This requires thorough logging, sampling, and testing of the formations comprising the producing interval. A complete core through the producing interval will be helpful, though a detailed electrical log will often be sufficient in later wells in a field where the reservoir strata in the early wells have been mechanically cored. Often the wells may be allowed to produce for a time to observe their performance before deciding which completion techniques will eventually be applied.

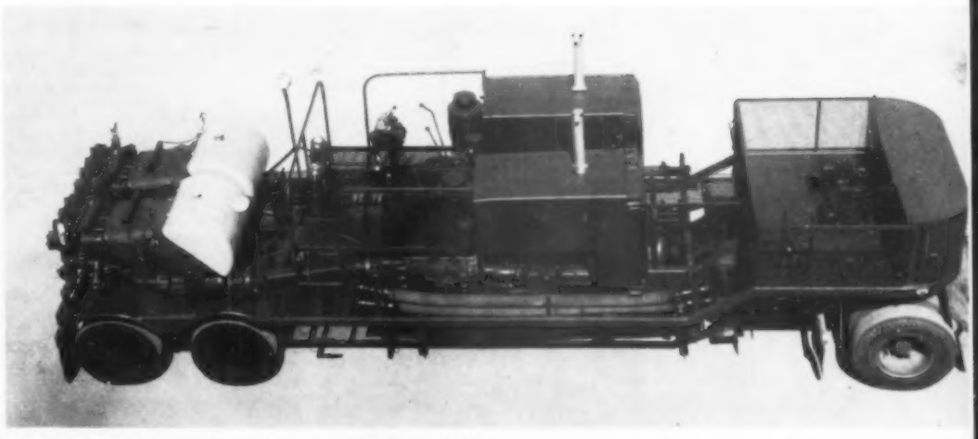
Only wells which display caving tendencies, or where influx of sand from the reservoir rock is troublesome, need be equipped with screen pipe. Slotted pipe will often serve to restrain sand influx. Gravel packs will be helpful in dealing with fine-grained sand particles which other types of screens do not control satisfactorily. Wall scraping or treatment with mud acid is always helpful if the pore spaces of the wall rocks have become clogged with clay.

Cavities about wells within the producing formation should be advantageous under all conditions. Explosives should be used for this purpose only in the harder well-indurated sandstones, limestones, and dolomites. Hydraulic excavation of well cavities with subsequent gravel packing should be successful in soft, unconsolidated and semi-consolidated reservoir sands. Acid treatment is helpful only in carbonate reservoir rocks. Hydraulic fracturing is particularly advantageous in low-permeability reservoirs, particularly where the producing formation consists of sand strata separated by shale or clay partings.

Some of the suggested methods of well completion are costly and time-consuming. Often economics will determine which techniques can profitably be employed. In some cases, the increased production secured will not be worth the cost of application as determined by a "payout" analysis. Competitive considerations may also be important in situations where wells must achieve

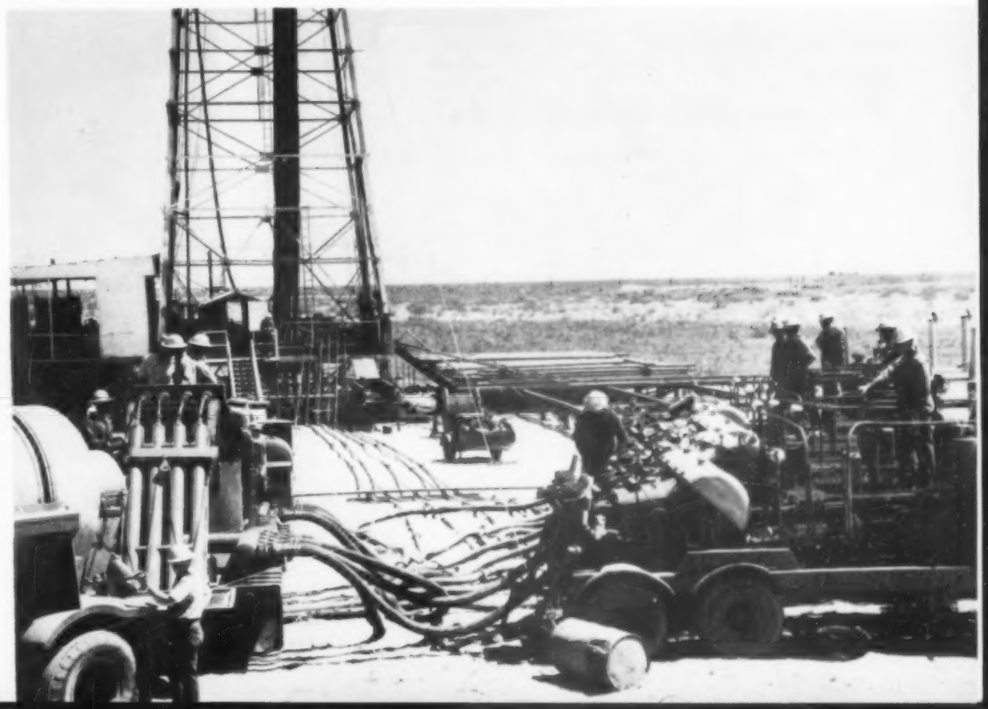


Equipment employed in a large-volume high-pressure sand-oil fracturing operation (Halliburton photo).

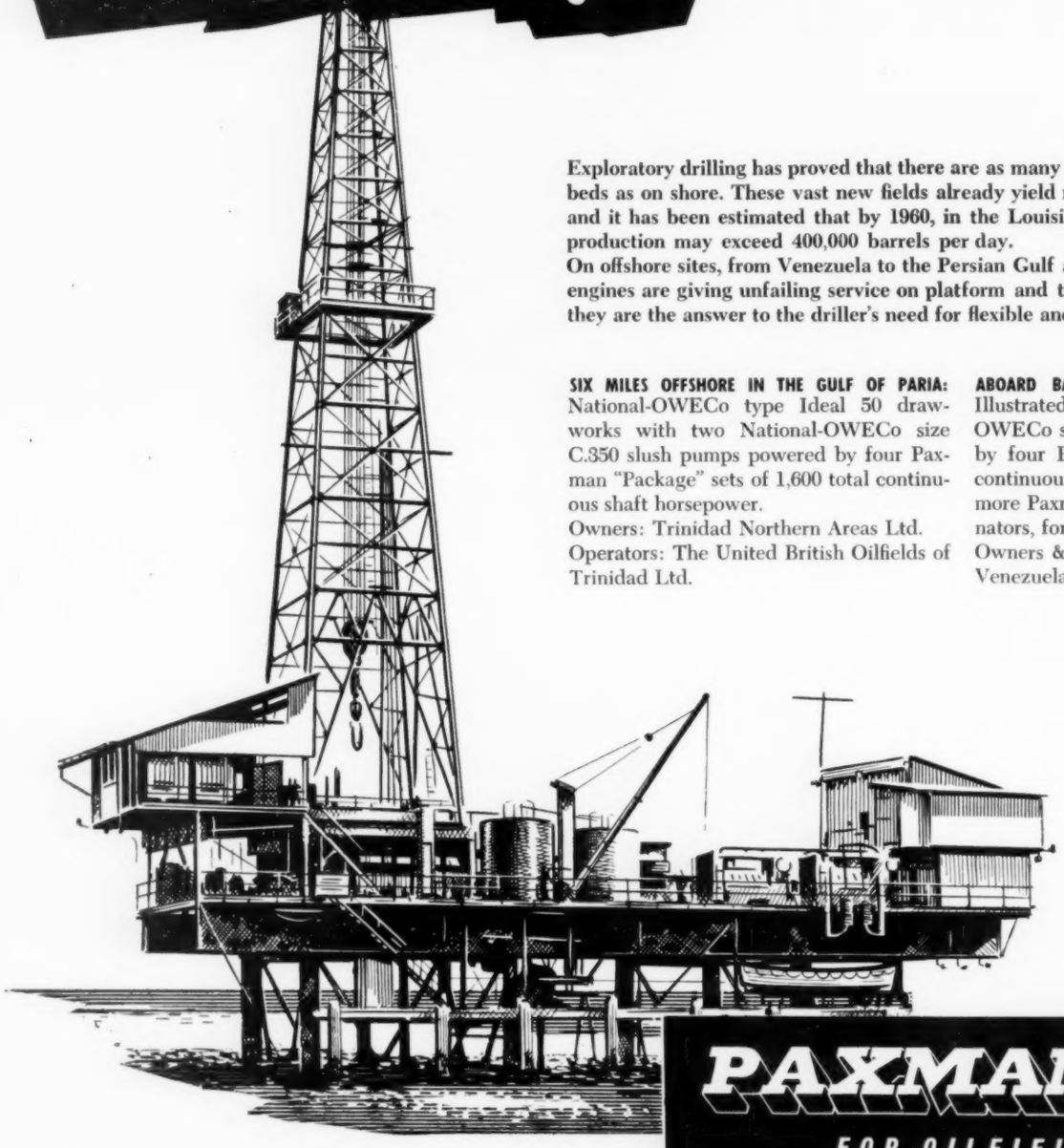


Hydraulic fracturing pumping unit equipped with two 335-hp diesel engines (Halliburton photo).

Equipment employed in a high-pressure large-volume hydraulic fracturing operation: Sand-oil blending equipment is at left; pumping units at right (Halliburton photo).



OFFSHORE...



Exploratory drilling has proved that there are as many oil prospects beneath the ocean beds as on shore. These vast new fields already yield many thousands of barrels daily and it has been estimated that by 1960, in the Louisiana-Texas offshore areas alone, production may exceed 400,000 barrels per day.
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Owners & Operators: Compania Shell de Venezuela.

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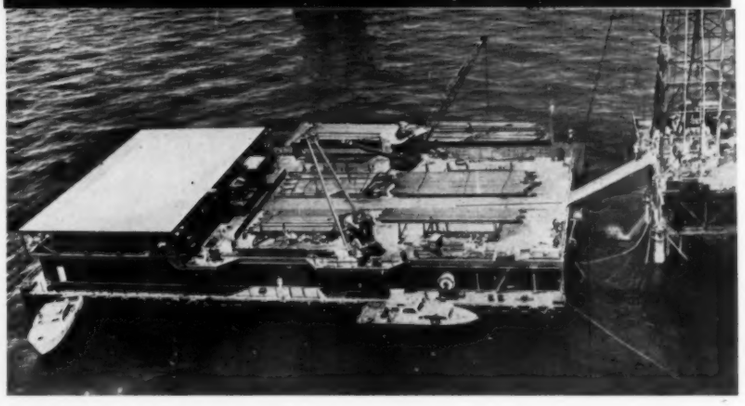

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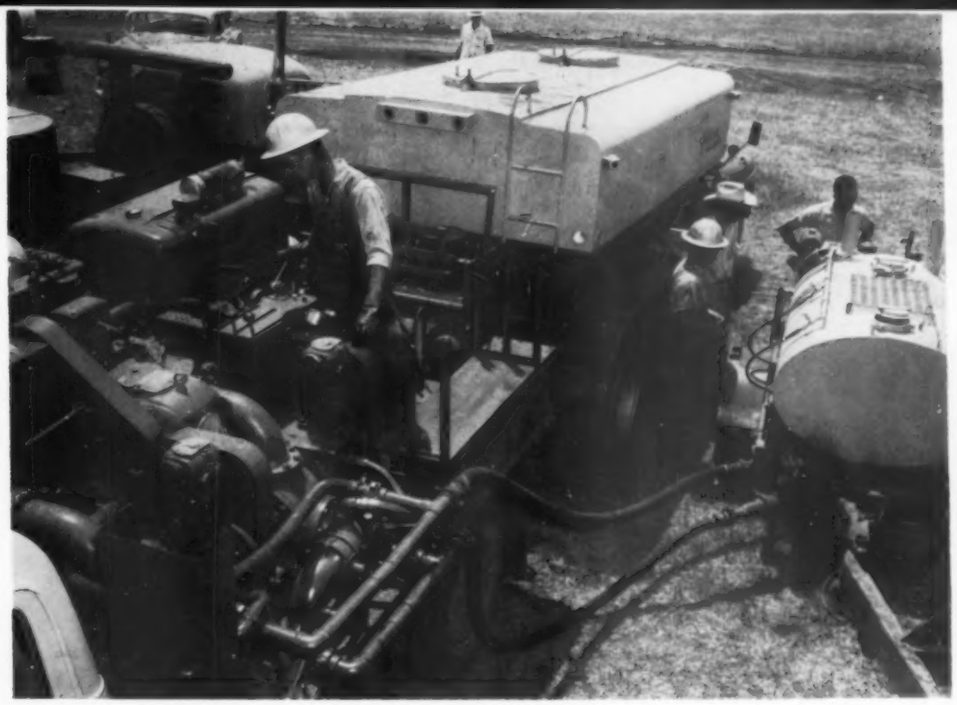

Bulk-sand carrier truck, chemical trailer, and sand-proportioning unit used in hydraulic fracturing operations (Halliburton photo).

maximum production during early life to avoid drainage to neighboring properties. On the other hand, proration restrictions may make expenditures for expensive completion methods unjustified.

Future improvement of well-completion techniques: While today's well-completion methods constitute a very great improvement over the primitive methods employed by the pioneer oil producers, it must not be assumed that we have attained the ultimate in well-completion techniques. As we continue to learn more of reservoir conditions and the behavior of reservoir fluids under varying conditions, new and better methods of well completion may be developed. Continued use of techniques already known will teach better ways of applying them. As oil and gas become more valuable, it will be found profitable to apply some of the more costly methods which today's prices will not justify. Research and skilled engineering supervision of field operations will provide the keys to further progress.

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International News and Notes

New French Units By Esso

A steam cracking unit of 4,600 b/d is being constructed by Esso Standard at Port Jerome refinery. Ethylene-purification, butadiene-recovery and purification units are also under construction for completion next year. The Butyl Rubber Co. (Soc. du Caoutchouc Butyl) is planning a synthetic rubber plant for production of about 50,000 tons yearly using the Port Jerome raw materials. Another installation for production of detergent-base materials, tetrapropyl benzene, will be in service at the end of 1958, also based on Port Jerome production. It will produce about 20,000 tons yearly.

New 2,000 B/D Cracker For France

Soc. Naphtachimie is planning a propylene and ethylene development program at its Lavera refinery. A new cracking unit is being constructed which will permit production of 100,000 tons annually, within three years' time.

Two New Wells For Israel

Of two new Israel wells, one at Heletz will be pumped due to poor showing on drill-stem test. Another at Brur was producing 165 b/d through 3/16-in. choke.

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Swiss Refinery Planned

An oil refinery is planned near Stabio, near the Italian border, in Switzerland. A former plant at Rotkreuz was dismantled several years ago and sent to Egypt; there are at present no other refineries in the country. Soc. Financiere Italo-Suisse is the builder, using Swiss and Italian capital.

Successful French Stock Issue

First public offering of $40 million in stock by an exploration company, Repfrance, which will finance oil exploration in France and the French Union, with some American companies, was oversubscribed in three hours recently. Repfrance (Cie. Francaise pour le Financement de la Recherche et de l'Exploitation du Petrole) is a holding company. It will be joined by American and French interests —including Sinclair Oil Corp. and Newmont Mining Co.—in the Sahara.

Delhi Enters Panama

Delhi-Taylor Oil Corp., Texas independent, has been granted a concession for exploration over 1,660,000 acres in Darien province, Panama. Duration is reportedly 4 years, plus 10 years extension. Oil law provides only 3 years, no specified extension.

West African Discovery

Additional oil finds are reported by Ste. des Petroles d'A.E.F., exploring in French Equitorial Africa. In the M'Bega area a discovery is reported at 2,574 ft. and another in the Tchengue area producing gas at 3,630 ft. Two wells in Pointe-Clairette found oil, with a well in the Animba area reportedly flowing at about 200 b/d. Drilling has begun by the company in the Middle Congo at Pointe Indienne, 30 km north of Pointe-Noire.

Jordan Well Progressing

No. 1 Safra, a wildcat by Edwin W. Pauley about 35 miles from the capital of Jordan, is drilling below 4,000 ft, with no results announced. 50% interest in the concession which covers ⅓ of Jordan is held by Phillips Petroleum Co.

Drillexco Seeks Bolivian Rights

Drilling and Exploration Co. has made application for 1,235,000 acres in Zone 1 of Bolivia. Bolivian Petroleum Corp. is the operating subsidiary for the company.

Algerian Consortium Applies

Sinclair (27%) and Newmont Mining Corp. (18%) have joined French companies (55%) to file for concessions in the Greater Sahara. The French 55% interest is divided 27% by a subsidiary of the French government's BRP, 18% by bankers Lazard Freres, and 10% by the French investment firm of l'Omnium de Valeurs Agricoles Industrielles et Minieres.

To Start Jordan Wildcat

Edwin Pauley will begin 2nd wildcat in Ramallah area soon, 12 miles north of Jerusalem. First well, near Kasr Mishash, 50 miles east of Amman, was below 4,000 ft with no shows.

Finland Refinery Onstream

Neste Oy new refinery is now onstream. Half of crude stock is supplied by Gulf and Shell, the rest by the Russians.

Arabian Wildcat To 2,893 Ft

Aramco's wildcat, Khurais No. 1, is now at 2,893 ft, and drilling ahead. It is testing new area about halfway between producing field Ghawar and preferential area over which Aramco has option, but no concession yet.

New wage increases of 8% on skilled to 15% on basic labor have been announced.

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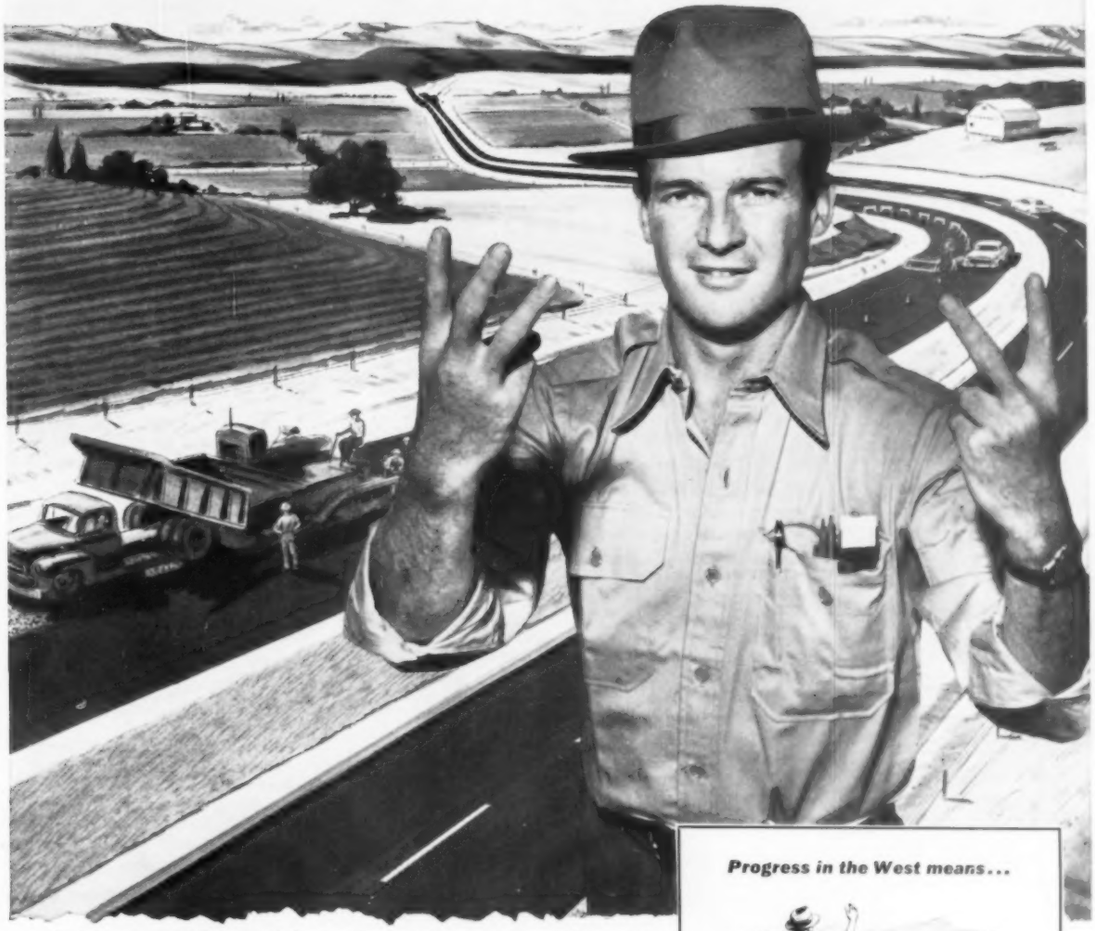

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Jordan Farmout

The concession granted to Jorge Zimiri, a Guatemalan, has been farmed out to J. W. Sparks, a Texas independent operator, associated with Robert Tyson and Harvey H. Hutchins, both from Jackson, Miss. Air magnetometer and seismic work are to begin shortly.

Turkish Oil Law Amended

Amendments of June 6, 1957 to Turkey's basic petroleum law include, among other provisions, (1) limited imports of foreign crude oil for local refining—Turkish product requirements to be given priority; (2) Council of Ministers to determine legal status of any pipeline crossing Turkey from foreign countries; (3) holders of oil rights to own land necessary for refinery building; (4) normal taxes for refineries against 50-50 basis for crude.

Seismic Survey In Pakistan

Geophysical Service International (USA) recently completed a seismic reflection survey over 9,000 square miles in Pakistan.

New Test Wells For Pakistan

Pakistan Petroleum Ltd. plans three more exploratory wells during 1957 at: (1) Lalmai, No. 1—a deep test near Comilla, in East Pakistan; (2) Bannh, No. 1—a deep test in Kalak Division, West Pakistan; (3) Adhi, No. 2—in Rawalpindi Division, West Pakistan.

Shell To Have Pakistan Test

Pakistan Shell Oil Co. Ltd. is planning to spud in its first test well in Pakistan in March of 1958.

Israel Gas Show

Gas encountered late in August on Be'eri license, 11 miles south of Heletz field, caught fire; extinguished by air drop. Well is being deepened for oil.

Jamaica Well Dry

Negril wildcat, by Pan Jamaican Oil Co., has been abandoned at 9,244 ft. The company described the well as "dry and abandoned," with no shows reported.

Libyan Wildcat Abandoned

Esso Standard has abandoned at 3,491 ft a wildcat at Haghe, in the Fezzan of Libya. Rig will be moved to Atshan area, 40 miles north, for another well. Mobil Oil of Canada's Fezzan wildcat, some 60 miles east of Haghe, went to 760 ft without promising shows.

3rd Well For Libyan American

Libyan American Oil Co. will sink its third well a few miles west of Barce in the Cyrenaican Jebel. Company's first two Libyan wells were dry.

Rigs For Libyan Desert

Oasis Oil Co. and Socony Mobil Oil of Canada are reported importing heavy drilling rigs for use in Libya's Syrtic desert. Mobil's drilling site is to be 125 miles south of Nofilia.

To Up Arabian Deliveries 8%

Tapline's capacity of 360,000 b/d gradually is to be increased by 8%—to 450,000 b/d early in 1958. $15 million additional permanent auxiliary pumping equipment is being installed—first effects of increase being felt in October of this year.

Brazil Refines 108,439 B/D

Petrobras reports Brazil's refineries processed 9,759,477 bbl (108,439 b/d) of crude during first three months of 1957. Bulk was imported crude, 7,747,699 bbl; remainder 2,011,788 bbl, was domestic crude.

Iran Approves Concession

Iran's government has approved officially a joint concession with Italian AGIP for exploration in three zones in southern Iran. According to annex to the agreement, AGIP will begin within four years drilling of one well in each of the three zones.

West Bengal's 2nd Test

A second test well by Standard-Vacuum is being drilled in India at Abhirampur, some 35 miles from Burdwan in West Bengal—where the first well, estimated to have cost $1.05 million—was unsuccessful at 10,000 ft.

Paraguan Product Prices To Rise

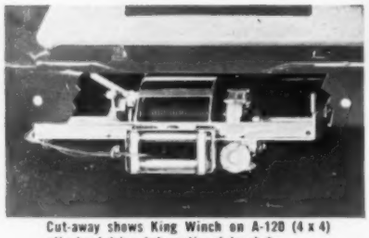
Government-controlled product prices in Paraguay are to rise still further, after a 20% increase in August. Last rise, following a shift to a single-rate free-exchange market for imports and exports, still leaves companies unable to operate profitably.

New French Tankers

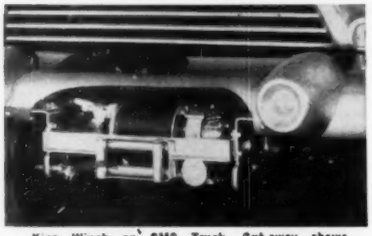
Soc. Maritime Shell has ordered three 75,000 dwt tankers from Chantiers de l'Atlantique, St. Nazaire—which shipbuilder already is constructing a 31,500 dwt and a 40,000 dwt vessel for the company.

Bulgaria's 1st Drill Rig

First oil drilling rig produced in Bulgaria has a height of 134,5 ft, a hook-load capacity of 330,600 lb, and a drilling depth of 9,843 ft. This rig is to be employed in the Kamchia area. Two more rigs are already under construction.



Cut-away shows King Winch on A-120 (4 x 4) all-wheel drive International truck.*



King Winch on GMC Truck. Cut-away shows underslung mounting, featuring new hi-tensile strength design.

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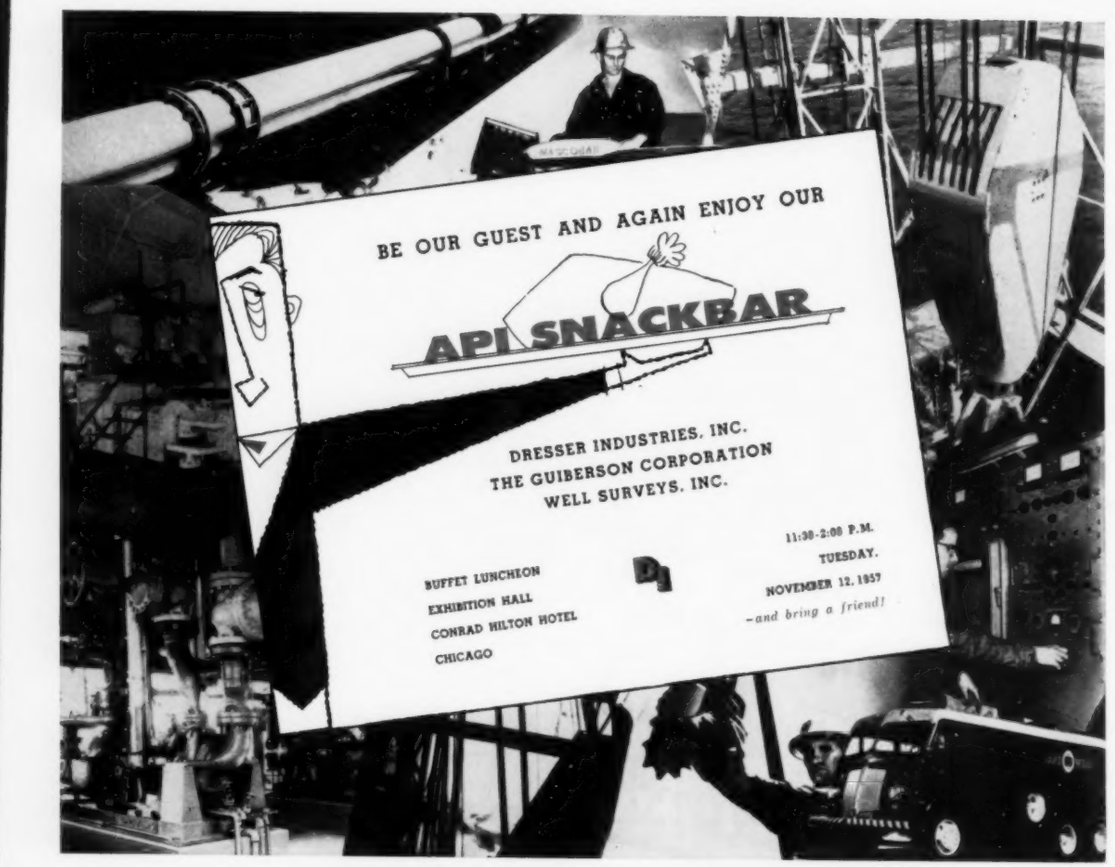

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Arab League Meets In Iraq

Arab League meeting to be held in Baghdad first week in October. Subjects include excluding oil from Israel, exchange of information on concession arrangements.

Japanese Apply In Iran

A 3-man Japanese group is negotiating for concessions in southeastern Iran, Chahbar province. Japanese government is backing them.

Algerian Concessions To French

Five exploration concessions have been awarded Cie. d'Exploration Petrolière, owned by French government and others—including British Petroleum. Total area is about 50,280 square miles.

Iran To Have 38-In. Line

Agreement for $500 million 38-in. pipeline from Qum discovery has been announced by Turkey. Capacity would be 160,000 b/d to 200,000 b/d initially. Economic justification for same is lacking, since Qum has not been fully evaluated yet.

Morocco Discovers Gas

Gas discovery at Djobel Kechoula is 25 miles east of Mogador.

Soviets For Syrian Refinery

Russian experts have been hired by the government to advise on its planned refinery at Homs. Price is reportedly far below fees requested by western consultants.

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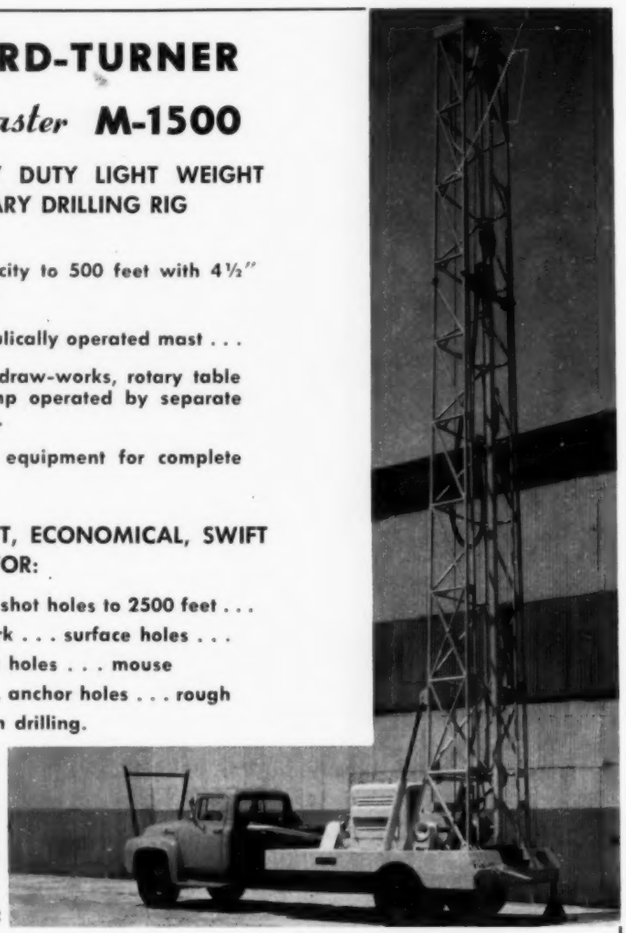

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Cities Service In Algeria

Cities Service will bid on concessions on 50-50 basis with French companies, including PREPA Co. and FRANCAREP. First is a government company.

Sardinian Acreage Leased

A concession over 3,500 square miles of western Sardinia has been received by Wintershall AG, a German company, jointly with Azioni Idrocarburi Sardegna (SAIS), a government company. Sardinia has favorable separate oil law from Italian mainland, as does also Sicily.

German Line Completed 1958

The 28-in. crude line from Wilhelmshaven to Cologne, about 230 miles, will be complete about this time next year. Initial capacity is 112,000 b/d—to be stepped up gradually to 440,000 b/d by 1975. Esso, BP, and four local companies are owners.

Wildcat In Timor

A wildcat well is planned at Aliambata by a local company, Timor Oil Ltd.

Sicily Large Producer

Ragusa field is becoming Europe's largest producer. Production during 1957 is estimated at 29,800 b/d, and will rise to 39,800 b/d during 1958 when the new pipeline and drilling programs permit increase in production.

850-Mile Line For India

Plans for an 850-mile pipeline are being completed by Burmah Oil Co. Ltd. The 20-in. line will have a number of river crossings which are being surveyed by Collins Construction Co., Houston. A refinery is scheduled to be built by the government. Location undecided as yet, it is tentatively to be at Barauni.

Gulf To Apply In Angola

Cabinda Gulf Oil Co. has been authorized by official decree to enter into contract with the government for exploration in Cabinda district.

Holland Drills 19 Wells

During 1956, 19 wells were drilled—of which 12 were development, 7 exploratory.

German Footage 11% Higher

Footage drilled during first half 1957 was about 1,228,582 ft—11% over first half 1956.

Imports of oil into Germany are down about 5.5% during first half 1957 compared with first half 1956. Major cause was Suez nationalization, when Western Hemisphere sources took over. Return has now been made to former Middle East sources.

German Refining Up 16%

Predicted refinery runs during 1958 are 16,008,000 metric tons (about 320,160 b/d)—some 16% over estimated 1957 runs.

Japan Manufactures Alcohol

Isopropyl alcohol, oil-based chemical, is being manufactured for first time in Japan.

Japanese Survey Coal and Oil

Government will survey for coal and oil during 1957-58 offshore from Akita, Yamagata, and Niigata prefectures.

Seeks Iranian Concessions

Jersey Standard's representative has been in Iran to discuss with government concessions outside consortium area.

BIG EVEN FOR TEXAS

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THE IMPORTS QUESTION continued

The Government's Viewpoint—Seaton

(Continued from page 54)

The President approved this recommendation and instructed that it be put into effect as rapidly as possible.

Before reaching this conclusion, the members of the Committee studied—and rejected—several alternatives. I would like to mention these, along with the reasons for their rejection.

1. *Import and store crude oil.* The practical problems of cost and the physical problems of storage made this approach impossible.
2. *Initiate a governmental program of oil exploration.* This course would violate the principles of our free-enterprise system and would require vast expenditures of public funds.
3. *Encourage importation of oil to conserve domestic supplies.* Adoption of this policy would result in a sharp decline in oil exploration in the United States. There could be no adequate appraisal of the nation's petroleum reserves.

The adopted program is simple, its mechanics plain. Established importers are requested to reduce their imports by 10 percent, using the average of the years 1954 through 1956 as a base.

Small companies and new importers (those importing less than 20,000 barrels daily in 1954) will be given an equitable opportunity to participate in the United States market. We have asked these firms to adhere to the schedules which they submitted to the Office of Defense Mobilization last July, except in those cases where individual imports would exceed 12,000 barrels daily over actual 1956 imports. Companies in this category are asked to import no more than 12,000 barrels per day over last year's levels.

Additional firms also should have an opportunity to enter the United States market. The purpose of the voluntary program is not to restrict competition among importing firms, nor to freeze the current market pattern. Companies desiring to import oil are requested to submit their plans to the Department of the Interior at least six months prior to the commencement of such operations. In this way, a determination can be made as to the most desirable way in which these firms can participate on a competitive basis but in harmony with the program.

The voluntary reduction program applies only to operations in Districts I through IV. These districts cover all areas of the United States except District V (Arizona, California, Nevada, Oregon and Washington). Since West Coast petroleum production is declining and all domestic crude available there competitively is being used, the problems of the Pacific Coast are sufficiently different for national interests to be best served by excluding that area from the program.

What do we seek to accomplish by the voluntary program? The estimates submitted by the importing companies in July of this year indicated they then planned to import an average of 970,000 barrels per day through December 31, 1957—about 16 percent of domestic production. The formula —as applied to affected companies—would reduce this volume to a yearly average of 756,000 barrels per day, about 12 percent of production.

The administration of the program was assigned to the Department of the Interior and on July 30, I appointed Captain Matthew V. Carson, Jr., of the United States Navy, as my special assistant to carry out this work. Captain Carson is an able executive. He is a lawyer, a combat commander, and—as counsel and later Director of the Naval Petroleum Reserves—he has a good working knowledge of the oil industry. I believe the program is in most capable hands.

On August 2, 1957, Captain Carson requested the individual cooperation of 22 importing companies. At that time, all companies indicated they would attempt to cooperate, with one exception. A few have raised subsequent reservations. Suggested allocations, as developed by application of the formula, have been published. Public hearings to adjust possible inequities have been concluded, and the importing companies are providing the requested data on their operations on a monthly basis. While it will be impossible to accurately measure the success of the voluntary program for several months, we are thus far encouraged.

There are, of course, important foreign policy aspects in this program. The oil reserves and productive capacities of other free nations are important to our national security. Many countries have important petroleum markets in the United States, and it is in our interest to promote the economic health of these friends and allies. I want to emphasize that the members of the President's Special Committee to Investigate Crude Oil Imports, gave serious consideration to the effect of the voluntary program on our relationships with our neighbors and allies. However, taking all factors into consideration, the Nation's security requires that a reasonable balance be maintained between oil imports and domestic petroleum production.

While the problem is far from simple, the facts are plain. Our nation must promote a sound program of domestic oil exploration through our private-enterprise structure. We must acquire a sound appraisal of the reserve petroleum potential of our nation. We must be prepared to meet any possible loss of imported petroleum supplies without resort to costly and time-consuming delays.

We would be remiss in our responsibilities to the people of the United States if we did otherwise. END

The "Established" Importer's Viewpoint—Supplee

(Continued from page 55)

would seethe with revolt.

Beyond the prospect of dispute, our industry must be able to seek oil throughout the free world and to seek markets for crude oil when found. This privilege alone is not enough. There must be opportunity to counter the risks of investment. The so-called "cheap oil" from many foreign sources is fraught with many risks, and the history of foreign crude-oil exploration and production is all too amply documented, right down to the present day, with examples of how investment can be threatened and actually lost. Hence, the hard-pressed domestic producer must be temperate in his disparagement of "cheap foreign oil." Even rich previous profits could become slim consolation if a huge investment should be wiped out by eventuality of existing risks. Even without such catastrophe, Atlantic has yet to find that foreign oil can be "cheap." As mentioned earlier, we are many millions of dollars behind recovery of our stake.

But if restriction is an unsatisfactory answer to the import problem, there isn't much comfort to be found in the opposite extreme of unrestrained free enterprise. In the postwar period, countries throughout the free world have been letting down the barriers against oil exploration. Indeed, as we know, many countries have cordially hung up the welcome sign. And our American oil industry, squirming under the discouragement of increasingly hard-to-find reserves, has gone abroad. Companies, large and small, experienced and tyro, have sallied forth. Most of them, of course, have been motivated by the promptings of their geologists, and wherever new exploration investments are being made, we can assume they are backed by geological optimism. If this optimism proves justified, even to a moderate degree, the rush of exploration and its sudden, wide spread could produce, for the near future, a flush of crude oil that will seriously aggravate our problems. Obviously, the exploring companies cannot long take risks without reward and, therefore, on a wide-open unrestrained basis, it is certainly true that an increasing flood of crude oil seeking the prime American market could have widespread ramifications. Tumbling crude prices could force more companies into the struggle to escape the strait-jacket of high domestic costs for new reserves. With proration already at a point of diminishing return as a cure, it doesn't require a flight of imagination to visualize the prospect of chaotic conditions. Low-priced oil for consumers is one thing.

Ruination of domestic producers is altogether different, and certainly cannot be in the public interest.

In examining our choices, we find, on one hand, that excessive import restriction would eliminate incentive to seek more of the world's oil and would intensify domestic competition, with the result of driving already high costs even higher. We would simply be in the vicious circle of higher costs requiring more protection, and more protection causing higher costs, to the detriment of what has always been the industry's greatest asset—the dynamic growth of consumption.

The other extreme, unrestrained free enterprise—in the face of the strong probability that floods of oil can result—simply establishes a different kind of vicious circle. Too much "cheap foreign oil" would force more and more domestic producers to seek that route of escape from the high-cost bind of their domestic efforts. Bad as the economic result might be, the interest of national defense have dictated that imports must not supplant domestic production.

By process of elimination in a choice of evils, we arrive at voluntary import restriction—not because we want it, but because alternatives are even less desirable. We have only to accept two premises: (1) that foreign oil must increasingly supplement our domestic supply; (2) that our whole industry's most vital single asset is dynamic consumption growth—and by acceptance of these premises find automatically our solution. It lies in the tolerance, moderation, and understanding emphasized at the beginning of this statement. If we are willing patiently to seek an equitable balance of opportunity between the "early birds" and the "Johnny come latelies," we will recognize that their respective investments must have opportunity for reward by participating in the growth of consumption; and we will recognize further that protecting the vast established investment of our domestic producing industry is basic to the industry's general health. Regulation based on these points will have a possibility of success because there can be a workable balance between opportunity and discretion. A company electing foreign exploration will know in advance that there will be limitations for profits on such investments. Yet, foreign ventures, with all their extra risks, and domestic efforts, in a more stable but costly environment, should both enjoy opportunities for profit reward if care is taken to preserve consumption growth.

Because the alternatives lead down such blind alleys, we have arrived now at the hard choice of a real voluntary restriction program. Disregarding legal uncertainties, certainly there can be more workable flexibility in a voluntary regulation program than in a compulsory one. Whether either can be made to work remains to be seen, for the political pressures of a democracy put a rough squeeze on economic regulation. But this statement attempts to set forth reasons for not embracing the illusion that complete absence of restraint would long escape a trail of consequences less desirable than we have experienced so far. END

The "New" Importer's Viewpoint—Adams

(Continued from page 56)

pattern fixing every set of circumstances to arise throughout the conflict.

An import formula must recognize the special conditions of, but not favor, individual companies. If it cannot be made flexible enough to accommodate all factors which press very hard at times and only slightly at other times, then it must be wholly reconstructed to fit the new circumstances.

Domestic producers and importers of oil, under any plan, should be enabled reasonably to evaluate the probable ebb and flow of future foreign supplies. There must be assurance that import volumes will not destroy the incentive of domestic producers to maintain their drilling programs. The pattern of the future must not be based on that of the past thus to deprive newcomers in foreign oil of the opportunity to realize on their investments.

No one can deny that this country cannot afford a level of current imports that would take chances with our national security but it is important to our security that the long-range import policy enable oil companies to lay their future plans with a stronger feeling of certainty than they now hold. END

The Domestic Producer's Viewpoint—Brown

(Continued from page 57)

oil reserves and production capacities of other free nations, as well as our own, are important to our national security. A number of countries inevitably depend in varying degree upon access to our domestic market for their petroleum exports and it must be recognized that it is also in the interest of our national security that our allies and friends have healthy and expanding economies. It is believed, however, that taking all factors into consideration, our national security requires the maintenance of some reasonable balance between imports and domestic production at this time. In light of the foregoing considerations, our recommendations are framed with the objective of limiting imports in order to maintain such a balance and yet to allow other nations to participate in the growth of our domestic demand to a degree consistent with our national security.

"It is our conviction that as a Nation we must pursue a careful, considered course that will permit reasonable imports into our country and still stimulate a dynamic and vigorous exploratory and development effort in this country.

"Domestic consumers are utilizing an increasing amount of petroleum products for transportation, fuel, heating and many other aspects of consumer life. In the event of a national emergency, it is essential to these consumers that there be adequate supplies at reasonable cost, both now and in the future. The low cost of imported oil is attractive, but excessive reliance upon it in the short run may put the nation in a long-term vulnerable position. Imported supplies could be cut off in an emergency and might well be diminished by events beyond our control. This vulnerability could easily result in a much higher cost, or even in the unavailability, of oil to consumers. It is therefore believed that the best interests of domestic consumers, as well as of national security, will be served if a reasonable balance is maintained between domestic and foreign supplies."

Here is a report of responsible representatives of our national government which, after considering the various positions which have been urged during the debates which have continued for more than 25 years, concluded that a proper relationship between imports and domestic production should be maintained in the national interest.

This is a challenge to the statesmanship of our industry. Unheeded, the consequences will be serious. Responded to, it could permit a more wholesome development of an essential national asset to the benefit of our entire country.

The President of the United States has suggested one plan for the solution. In doing so, the possible need for further action was anticipated. Whether the plan is pleasing or adequate, machinery has been provided for some action.

The President's action places direct responsibility on the industry to solve the import problem under the suggested plan or to support whichever additional means may be required.

This problem is sufficiently important and the challenge sufficiently definite to inspire the best minds in our industry. END

The Conservationist's Viewpoint—Thompson

(Continued from page 58)

healthy oil industry in the United States in event of emergency.

"We have established, I think beyond doubt, that in emergency the Western Hemisphere can supply the petroleum

(Continued on page 128)

To Expand Chilean Refinery

New Concon refinery in Chile is being expanded so as to have a capacity of 41,000 b/d by 1959. Output is to be held to 33,000 b/d until 1963 for want of a market. Now operating at 20,000 b/d, the plant turned out 14,700 b/d of products during 1956, after limited production in 1954-55. Gasoline octane rating of 76 will increase to 78 with completion and expansion—to 85 for premium grade.

BP To Apply For Sahara Rights

British Petroleum Co. Ltd. is to apply, through its French associates Cie. Française des Pétroles and Cie. Française des Pétroles (Algérie), for exploration concessions in the Sahara.

By French law, concessions are granted only to organizations having at least a 50% French interest. These concessions last for five years—at the end of which 50% of the concessional area is to be handed back to the State.

Neutral Zone Record Exports

Crude exports from the Neutral Zone by American Independent Oil Co. were a record 33,767 b/d in July, and averaged 20,047 b/d during first seven months. Getty Oil Co.'s record July exports were 36,590 b/d, and averaged 30,847 b/d during first seven months.

New Tankers For Israel

Israel will purchase a number of 50,000 dwt tankers in addition to the two 19,000 dwt vessels now being built for this country in Germany.

Kuwait Exports Down 5%

July crude exports by Kuwait Oil Co. of 1,253,100 b/d were down 5% from June. First seven months' exports averaged 990,000 b/d.

Iraqi Oil Discussions

Dr. Nadim Pachachi, Iraqi minister of petroleum, recently was in London to discuss with Iraq Petroleum Co. the oil situation in Iraq. Subjects included increased Iraqi production and the new oil agreement between the Iranian NIOC and the Italian AGIP.

Polish Tankers For USSR

The "Georgi Dimitrov" shipbuilding yard in Varna, Poland, laid the keel for the first six 4,000-ton tankers which are to be delivered to the Soviet Union by 1960. The tanker is 404 ft long and 53 ft wide, and is designed both for sea and river use.

Catalyst Production In Holland

The Royal sulfuric-acid factory at Amsterdam, The Netherlands, and American Cyanamid Co. are building a new factory for the manufacture of catalysts and other products for Esso Petroleum Co.'s refineries outside the USA.

New Dutch Refinery

Standard Oil Co. of New Jersey is to build a new 90,000 b/d refinery at Rotterdam. With construction to start early next year, completion is scheduled for 1960. Estimated cost is $45 million.

BP Earnings Down Due To Suez

Net earnings of British Petroleum Co. Ltd. declined to an equivalent of $62,717,200 for the six-months ended June 30—down from $94,347,200 for the same 1956 period. Company directors attribute the decline to adverse conditions resulting from Suez Canal closure.

New Jetty For Scotland

Construction has started on a new jetty for British Petroleum Co. at the Finnart terminal on Loch Long, Scotland. About 330 ft long, the jetty is connected to shore by two arms each 180 ft long. Depth of water at low tide is 55 ft to accomodate largest tankers projected by the company.

Third Dry Hole By Hunt In Pakistan

Hunt interests in Pakistan have abandoned their third wildcat well, near Sari Sing. Two previous wells were located on the Dhak structure. Drilling rig is being set up at Sunbak structure, 8 miles NE of Thana Bula Khan.

New Sahara Group

A new Franco-American Sahara oil prospecting group has been formed, in which participants are Cities Services Co. 50%, PREPA 30%, and FRANCAREP 30%.

Oil Shows Reported In Denmark

Oil shows have been found in a water well at shallow depth, according to reports in the press. Location was about 39 miles northwest of Copenhagen, on the island of Seeland.

Jersey Standard will drill its first well on the Jutland coast late this year. Danish American Prospecting Co. is the operating concern, acquired from Gulf last year after considerable exploration expenditure and six dry holes by Gulf.

Plymouth To Enter Ivory Coast

Plymouth Oil Co., independent oil company from Pittsburgh, may enter the Ivory Coast of Africa for exploration with Soc. Africaine des Petroles. The latter company recently received a 3,700 sq. mi. exploration permit on July 29, 1957. The permit is known as Eboinda and has an initial duration of three years, with provision for three renewals of 2 years each. Minimum expenditure in first three years is 200 million francs and 400 million francs (CFA) in each renewal. Maps of the exploration area are available.

NAPIER PACKS CRACK LINER SPEEDS INTO 70 FT. CREW BOATS!

3 visible reasons why Napiers were chosen

1 INCREASED PAYLOAD. The most powerful engine for its size and weight in the world, the Deltic takes up less space than engines of comparable horse power. In this case room was made for seating 50 passengers.

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3 ALL WEATHER PERFORMANCE. In rough weather Shell Boats get the best of both worlds. Unlike helicopters, they can still operate and still maintain their relative speed advantage over existing surface transportation.

Employees of the Compañia Shell de Venezuela are now transported to offshore drilling platforms in Napier Deltic powered crew boats that move *faster than crack Atlantic liners*. This is a big advance on existing slow surface transportation or helicopters with small payload and high operating and maintenance cost.

Power for the boats comes from two 9-cylinder opposed piston diesels. These Deltics with their "triangle" of cylinders ensure an amazing balance and freedom from vibration even with 1,620 h.p. in the engine room.

Fast, reliable, all-weather movement of men and materials has become a must for all offshore oil operations if they are to run on an economic round-the-clock basis. Napier Deltics provide twin-engined reliability and drive the fully-loaded, 50-passenger Shell Boats at an easy and safe 35 m.p.h. under continuous cruise conditions.

Plans of Napier Deltic powered crew boats specially designed for Gulf operation are available. For more information on the Deltic diesel contact the Napier Representative—L. O. Brooks, 909 Dupont Circle Building, Washington 6, D.C. Phone North 7-0146.

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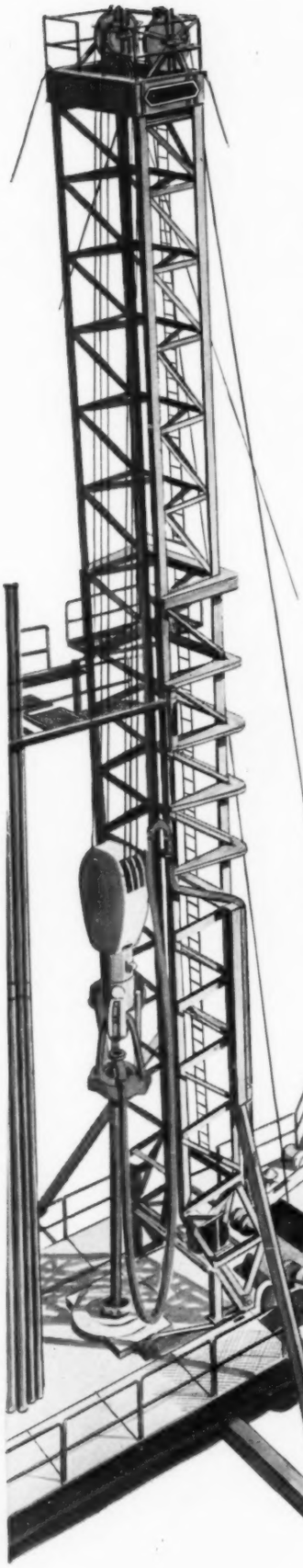
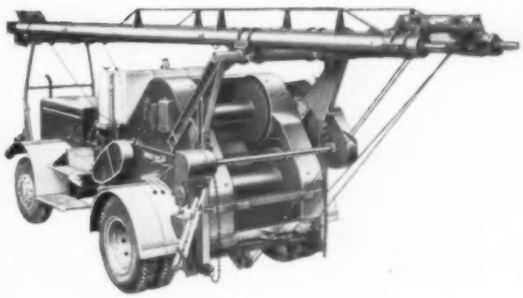
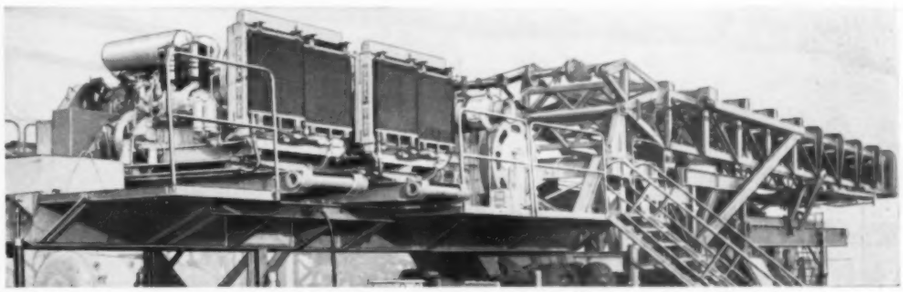
IDECO WOODFIELD OF ROCHESTER

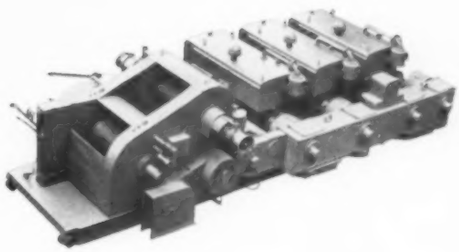


Woodfield are licensees in the United Kingdom for the manufacture and sale of the range of IDECO drilling and production equipment.
The Woodfield plant at Rochester, constantly developing and enlarging its facilities, provides the means of producing first-class equipment. This, combined with frequent visits of senior technical and service personnel to fields and installations the world over, provides a service indispensable to operators requiring special equipment.





Top illustration:
Woodfield "Fieldmaster" Mobile Well Servicing and Workover Rig. Well depths up to 4,000 ft.
Centre illustration:
WOODFIELD built IDECO Hydrair H-575 Dual Rambler drilling and servicing rig for wells 7,000/8,000 ft. depth. Drilling to 7,500 ft. with 4½" drill pipe.
Right illustration:
WOODFIELD built IDECO Hydrair H-40-D Double drum draw-works with 3 AEC engines, 450 H.P. and 4 shaft drive compound.
Lower right illustration:
WOODFIELD built IDECO H-20 double drum Well Servicing Rig. Well depth 3,000-4,000 ft.



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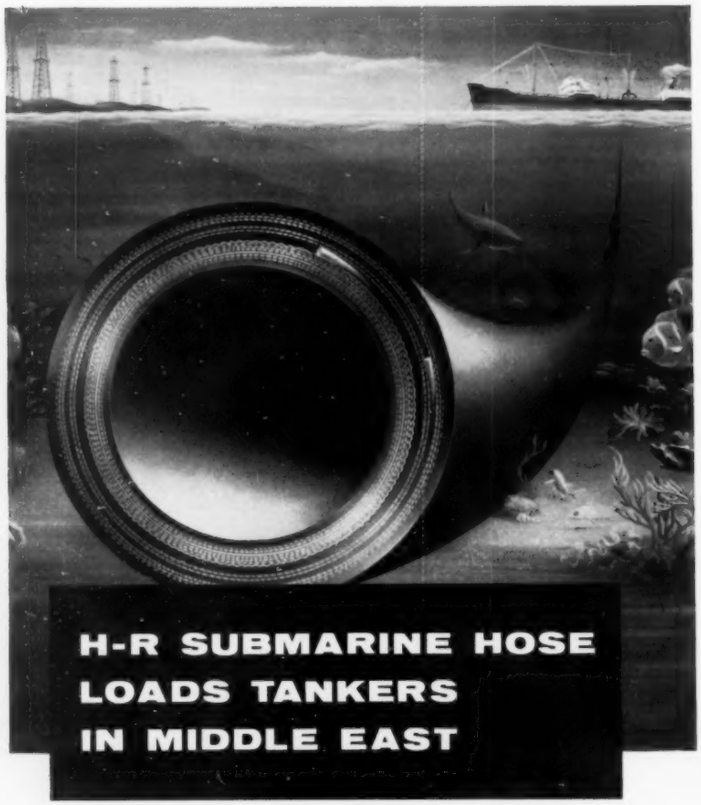

During several years of service in the Eastern Mediterranean for the Trans-Arabian Pipe Line Company, three lengths of Hewitt-Robins 12" Submarine Hose have loaded 1,295 tankers with 169,334,955 barrels of oil. Another length, in service six years, has loaded 1,603 ships with 232,713,229 barrels. This remarkable record is evidence of the extreme strength and flexibility of this sea loading hose. For it withstood constant flexing by wave-tossed tankers, the abrasive action of sand and silt, and the corrosive action of oil and salt water.

Also from Trans-Arabian come test reports of Hewitt-Robins 15¼" I. D. Submarine Hose. Results: increased loading capacity for today's super tankers. To find out how H-R products and services can help your organization, contact one of our foreign subsidiaries or write to our Export Department in the U. S. A.

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The Conservationist's Viewpoint—Thompson

(Continued from page 125)

needs, requirements of the Western world for a limited time, but we cannot do it forever, but we can do that only if there is continued exploration and maintenance of reserves in this country.

"If it were simple, so simple that you could say, 'let's close up all our wells, import all our oil,' that might be a very cheap and temporarily successful policy. But you would strangle the oil industry and there would be none in this country; and so when an emergency came, it would not be a flourishing industry, and you couldn't depend on it."

As for the West Coast, the President said that "they have quite a bit of oil out there themselves; and, in addition to that, we are going to have to depend on water, we are going to have to depend on Venezuelan oil, make no mistake, we are not going to supply all of the oil that we produce anywhere."

Any lowering of allowable production in Texas would reduce the incentive for drilling in the search for new oil fields and in the development of known reservoirs.

This reduction would be more compelling and disastrous to the smaller independents who must have production income to obtain loans and pay interest and repay loans.

Interest rates are now higher and loans more difficult to obtain. Then, too, in some cases a compensating balance is required to be maintained with the lending bank.

It is well known to all that reserves in oil and gas can be maintained only by constant search for new fields.

There is only the inducement of probable rewards as compared with the financial risks involved.

The smaller the allowables and the fewer days operators are allowed to produce, the quicker will the independents be squeezed out of the oil-producing business.

The old ratio of success in finding two barrels of reserves for each barrel of production has dropped to the ratio of 1.3 to one barrel. Also, the number of barrels of oil found per foot of hole drilled has declined.

We know that the smaller the incentive, the less drilling will be done. We know we need the oil; therefore, the natural solution is to encourage exploration and drilling to get the oil for national security.

True conservation means wise use for the good of our people.

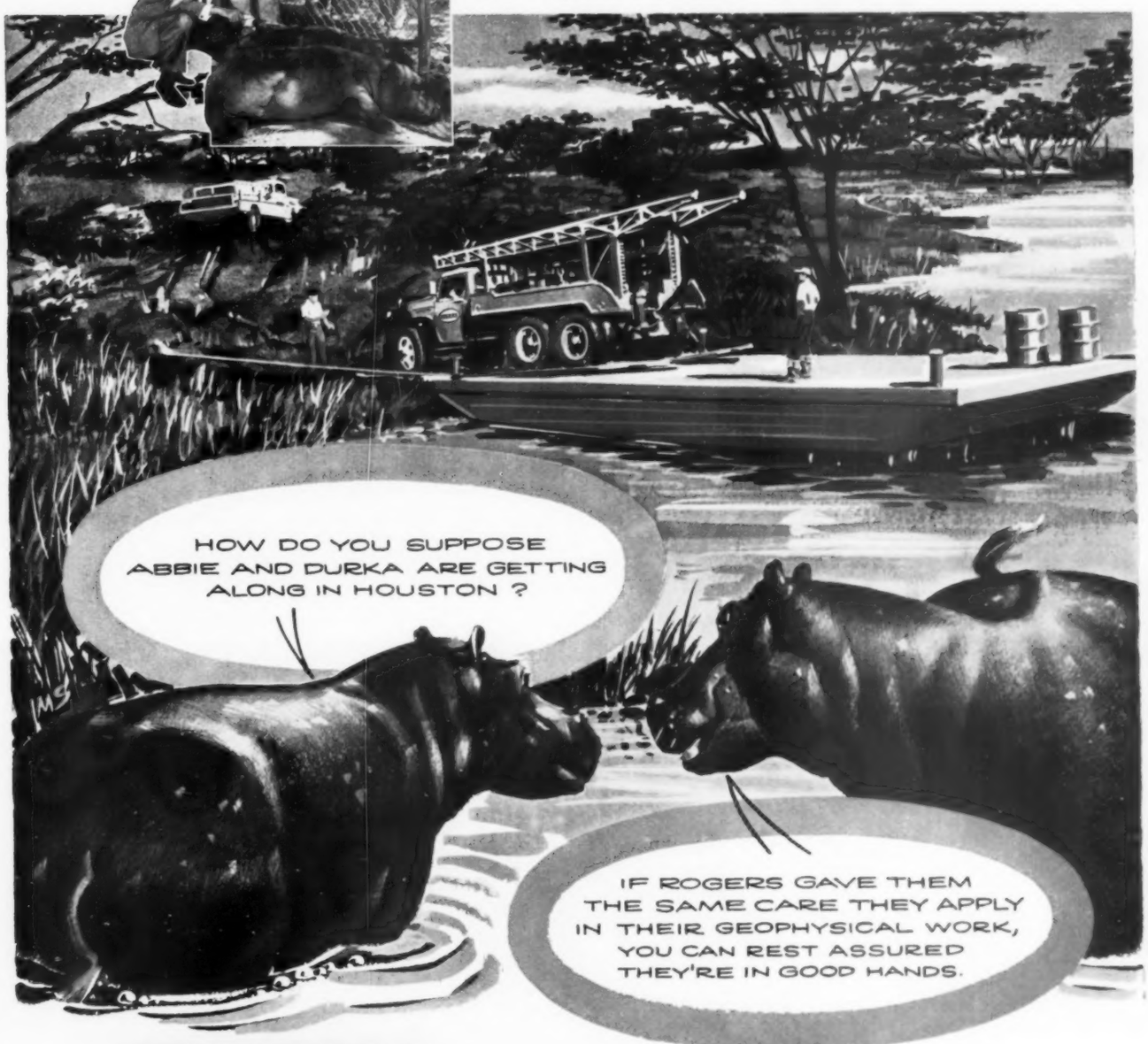
It does not mean the locking up of our natural resources. Conservation does not mean hoarding.

Further restriction in oil and gas production would cause the producing industry, or parts of it, at least, to wither and die. That would mean less oil for our defense.

If you produce oil at the most efficient rate so as to fully utilize the energy, if you encourage secondary recovery and reward new discoveries, you will have reached the aims of true conservation through the best scientific methods known to man. That is the aim and ideal toward which we work.

Sam D. Rogers, President, Rogers Geophysical Company, is shown here with Abbie and Durka, the two six-months-old Hippos captured in the area where Rogers' crews are working in Somaliland and presented by Mr. Rogers to the Houston, Texas, Hermann Park Zoo.

The names, Abbie and Durka were given to the Hippos by members of Rogers Geophysical crews prior to the Hippos' departure, via air freight, from Somaliland.


HOW DO YOU SUPPOSE ABBIE AND DURKA ARE GETTING ALONG IN HOUSTON ?
IF ROGERS GAVE THEM THE SAME CARE THEY APPLY IN THEIR GEOPHYSICAL WORK, YOU CAN REST ASSURED THEY'RE IN GOOD HANDS.

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ROGERS' CREWS GO EVERYWHERE

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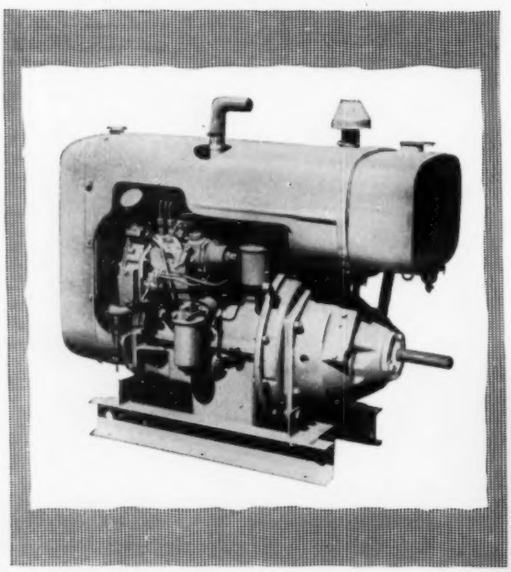
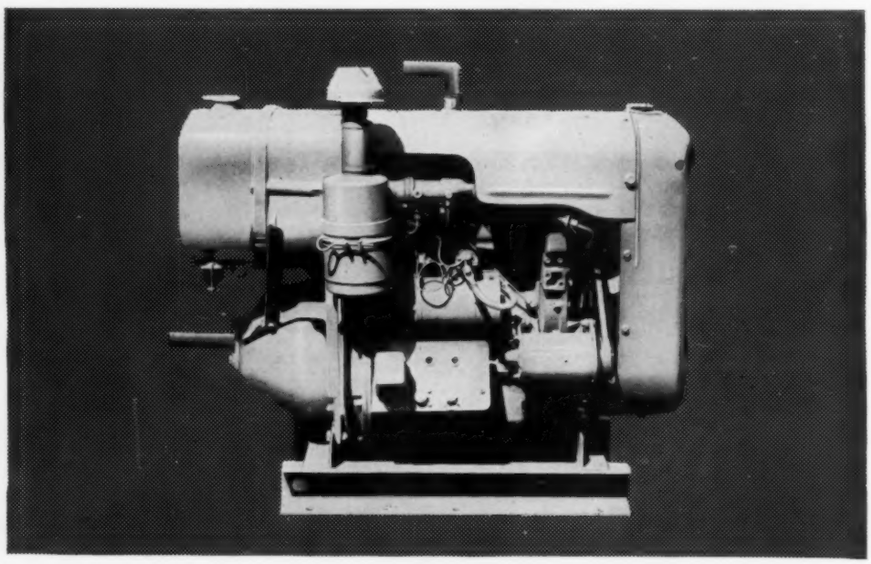


Following world-wide demand for a small—compact — lightweight — self-contained and low-priced power unit the P3/144 (I) has now been introduced for the benefit of manufacturers and operators of road construction machinery and the lighter types of industrial application. The unit comprises the well tried P3/144 diesel engine, complete with seven-gallon fuel tank, filters, instrument panel, 12-volt electrics, temperate radiator, radiator cowl and top canopy. Other notable features are a heavy duty air cleaner, Borg & Beck clutch, thermostat, six-bladed fan, and provision for fitment of a hydraulic pump. Fitted with direct drive power take-off, a 3.6:1 reduction gear can be supplied on request. Perkins overseas Companies, distributors, dealers and the manufacturers who standardize on Perkins engines, ensure that Perkins Service and Spares are readily available everywhere.

ENGINE SPECIFICATIONS

No. of Cylinders	3	3
Bore	3½ in.	88.9 mm
Stroke	5 in.	127 mm
Capacity	144 cu. in.	2,360 c.c.
Compression ratio	16.5:1	16.5:1
Maximum rating	28.25 BHP at 1800 RPM	28.7 PS at 1800 RPM
Maximum torque	84 lb. ft. at 1200 RPM	11.61 kgm at 1200 RPM
Weight	882 lbs.	400 kg.



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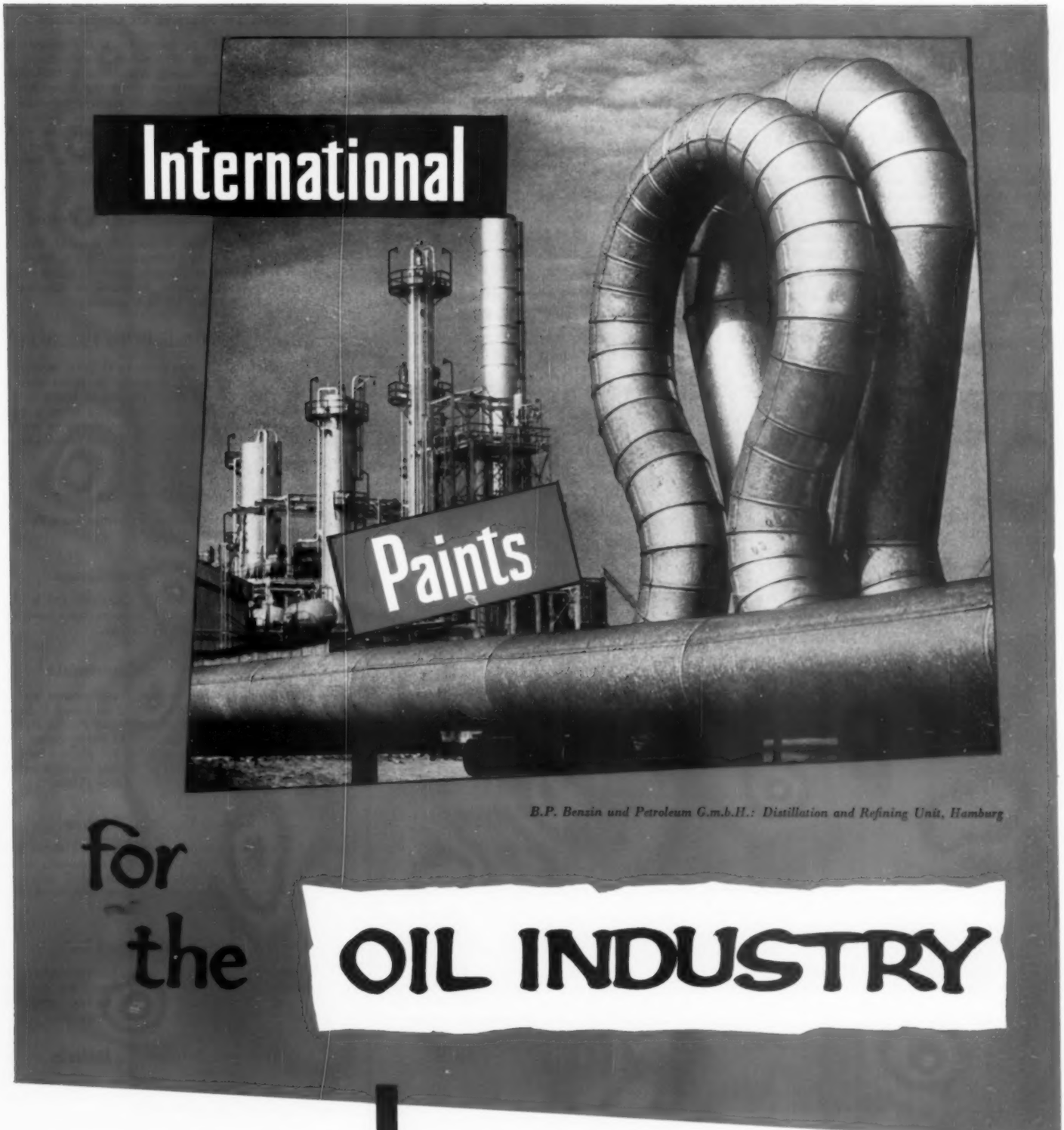

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Latin American Oil News

Considers Bolivian Bids

Official sources say decision on bids by USA companies for 108,000-acre Madrejones area, bordering Argentina, ultimately will be by president and congress. Advance favoring of any particular bid has been denied. Following bids are under consideration: 1, Petrofina; 2, Bolivian Gulf; 3, North Am. Utility & Construction, Fish Engineering, Petroleum Machinery & Services; 4, Godfrey Madlener, Savoy Oil, Hydrocarbon Oil Corp., Wendell Phillips; 5, Oil & Gas Property Management; 6, J. Christensen Financial Corp.

Ecuadorian Success For SOC

California Ecuador Petroleum Co., Standard of California subsidiary, found important oil and gas shows at No. 1 Santo Domingo wildcat.

French To Build Paraguay Line

10,000 b/d 422-mile crude line from Bolivian border to Asuncion, on Paraguay River, will be built by Fives Lille, French firm. 3,000 b/d refinery at Asuncion also will be built; completion scheduled in 2 years. $11.8 million cost will be paid over 7-year period by Paraguayan government.

Free your "HANDS" to use their HEADS

Machines search the records, men are free to think with Petroleum Information's new system of well history control using IBM punched cards.

The system is in use on the Pacific Coast, is in planning stages for the Rocky Mountain Region. All data on all wells in areas covered is accurately transcribed to punched cards . . . is instantly available in any required form to the geologist, engineer or policy level executive whose informed decisions must shape a company's destiny.

Adaptation of background oil industry data to electronic methods of handling and presentation is the latest addition to a growing list of Petroleum Information services to the industry. Nearly 30 years of experience in collection, interpretation and presentation of field data to the oil industry backs up all PI publications, maps and related services.

The IBM well history control system is our latest achievement in the constant effort to fit data into the most modern of formats, with but one objective . . . to free your "hands" to use their heads!

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PETROLEUM INFORMATION

SOC To Market In Costa Rica

$1.2 million will be spent by Cia. Petrolera de California, Standard of California subsidiary, on marketing facilities during remainder of 1957. Most will go for service stations along the Inter-American Highway; bulk stations, marine terminal at Puntarenas; and tank trucks and cars. A 20-year contract has a most-favored-company clause which extends benefits of any concession given other distributing companies which include Union, Texaco, and Esso.

Costa Rican Cocolas Abandoned

Union Oil Co. has abandoned drill at Cocolas site after Cocolas No. 4 was dry at 7,000 ft. Exploration will continue at Victoria about 13 miles inland from Limon port, under direction of Charles S. Martin, new manager for the company.

Nicaraguan Offshore To 13,559 Ft.

Waterford Oil Co. was down to 13,559 ft in August with exploratory well offshore, 38 miles east of Punta Gorda. Well will be carried to 16,000 ft, according to the company. Drilling is from a submersible barge. Gulf Oil Co., part owner of Waterford, drilled well onshore in 1941, and found granite at 6,200 ft.

Mexico To Have Gas Line

600-mile natural-gas line is planned from Tabasco to Mexico City.

Bolivia Seeks Concessions

White Eagle International, Blackwell Oil & Gas, and Western Hemisphere Petroleum have been invited to take concession in Bolivia.

$15 Million For Guatemala

$15 million will be spent on exploration during 1957. Two wells are being drilled by Story J. Sloan at Bananera; two more planned near Puerto Barios, and others at San Felipe and El Estor. Socal will drill near Livingston soon. Ohio Oil plans a well at La Arruga Grande, and is moving in equipment. Continental Oil will drill near Lake Flores.

Chilean Footage Higher

15 wells were completed during first quarter 1957—of which 6 were exploration, 2 extension, and 7 production. Of the total, 6 found oil, 1 gas, and 8 were dry. Footage drilled was 109,329—higher than last year's first quarter.

Cuban Well Closed In

Consolidated Cuban No. 4 has been completed in Bacuranao-Cruz Verde field. It flowed 600 bbl first two hours. Partly closed in due to high pressure, 2-in. pipe is pumping leakage oil from pit.

Cataract Applies In Bolivia

Cataract Mining has applied for 285,000 acres in Zone 1 Chiquitos province, Santa Cruz—with $22,950 deposit.

American Zinc In Bolivia

Government is studying American Zinc Co.'s proposed $80 million tin shelter—with interest in oil exploration.

4-Year Concessions In Paraguay

Of nine 4-year concessions granted totaling 750,000 acres, latest five are east of Paraguay River including one to a new company, Cia. Goyelita Petrolera y Minera Paraguaya SA (Argentine, Paraguay, Chile, and American capital). Three are to Cervasia Recaldo Cespedes, Braham Wishievsky, and Oscar Armando Gomez. Fourth, covering 741,000 acres, is to Amelio Martinez in zone of Alto Parana.

This tubing goes to any depths for oil

TO meet the current trend to deeper wells and higher pressures, the Timken Company developed a high-strength oil well tubing of exceptional uniformity and ductility.

This tubing offers a yield strength up to 125,000 PSI. It's 20% stronger than required by the stiffest API specification—5A. It can take internal pressures up to 15,000 PSI. Actually, the well hasn't yet been drilled that can produce all the pressure Timken® seamless steel tubing can take.

Whatever your specific oil or gas well tubing problem, Timken seamless steel tubing provides a ready solution. For 24 years we have been making high pressure seamless tubing for special requirements, in a wide variety of sizes and analyses. Send for free engineering study, "Timken Oil And Gas Well Tubing", a study of various alloys for high strength and corrosion resistance. Write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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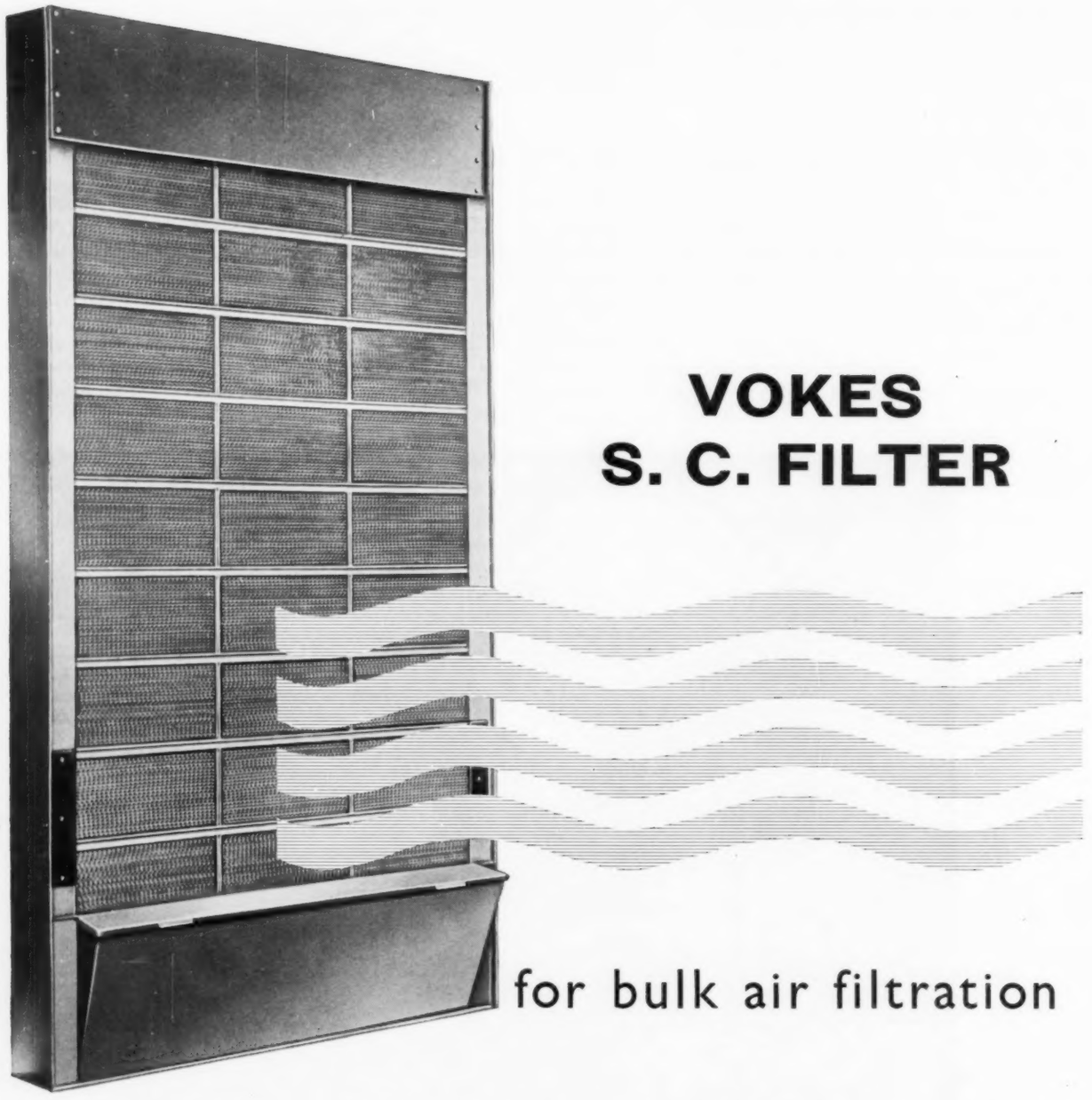

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- Can be fitted with sprinkler system where severe fire risks exist

The Vokes self-cleaning rotary screen filter is ideal for use where very large volumes of air have to be cleaned, but an exceptional degree of cleanliness is not essential. The special type of filter element employed combines minimum maintenance and servicing with constant efficiency and high dust holding capacity. Any number of units may be used together without complex interconnection of the driving mechanisms. Completely automatic in operation, the filter panels circulate through a trough of oil. A unique agitating mechanism in this trough ensures maximum removal of entrained dirt and dust from the filter cells during the cleaning cycle. The only servicing necessary is periodic removal of sludge and maintenance of correct oil level. Please write for fully illustrated technical literature.

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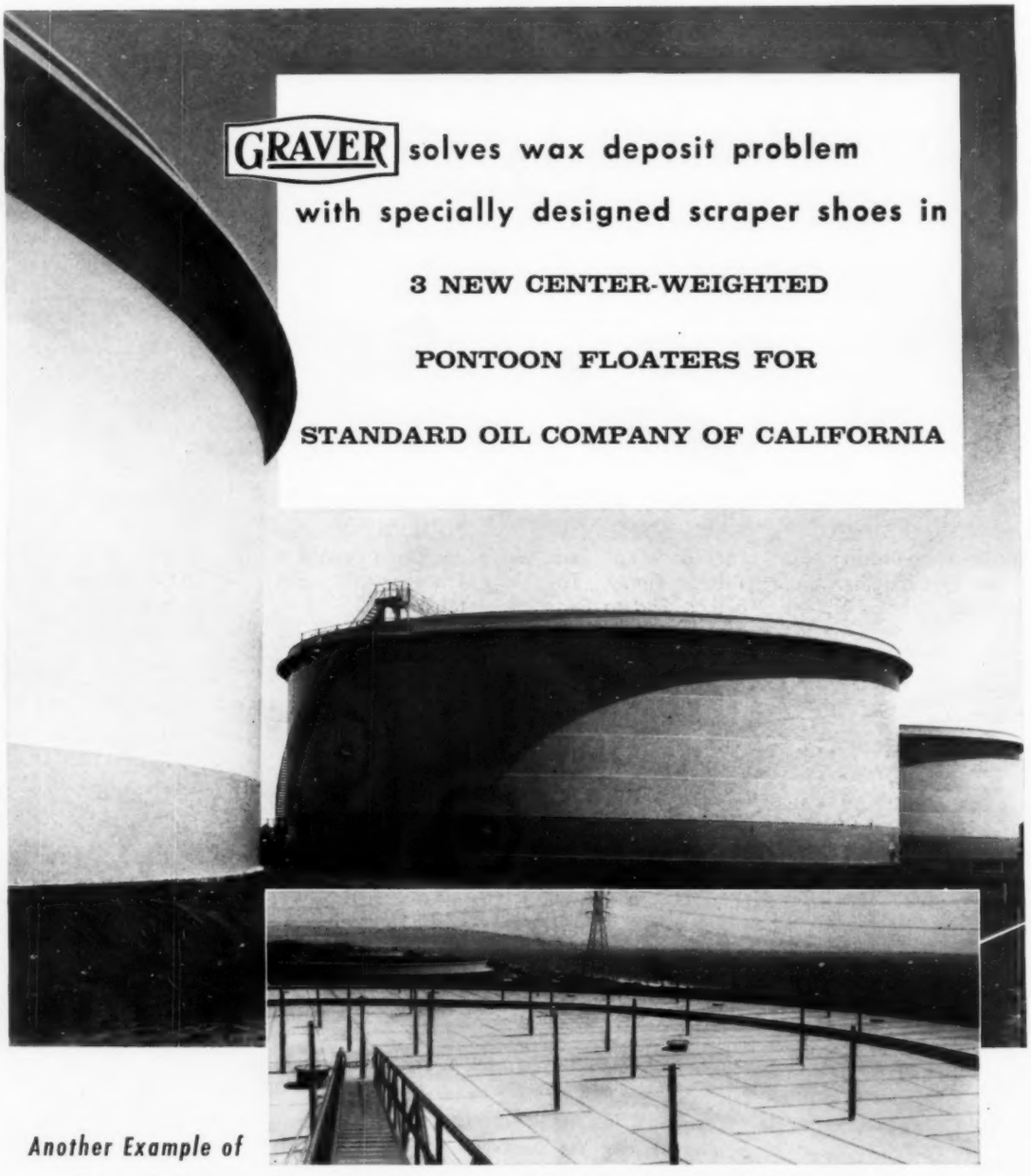

GRAVER solves wax deposit problem with specially designed scraper shoes in

3 NEW CENTER-WEIGHTED PONTOON FLOATERS FOR STANDARD OIL COMPANY OF CALIFORNIA

Another Example of Graver's Design and Engineering Leadership

These three new Graver 160,000 bbl. floating roof tanks, with the center weight *under the deck*, were selected by Standard Oil Company of California as suitable for high wax content crude. This type crude may create a problem of wax build-up on the tank shell. Graver designed a special shoe of Type 304 stainless steel to provide a scraper action as the roof descends. This stainless shoe and the unique, lower-cost under-deck center-weighted roof design are examples of Graver's imaginative design and engineering leadership.

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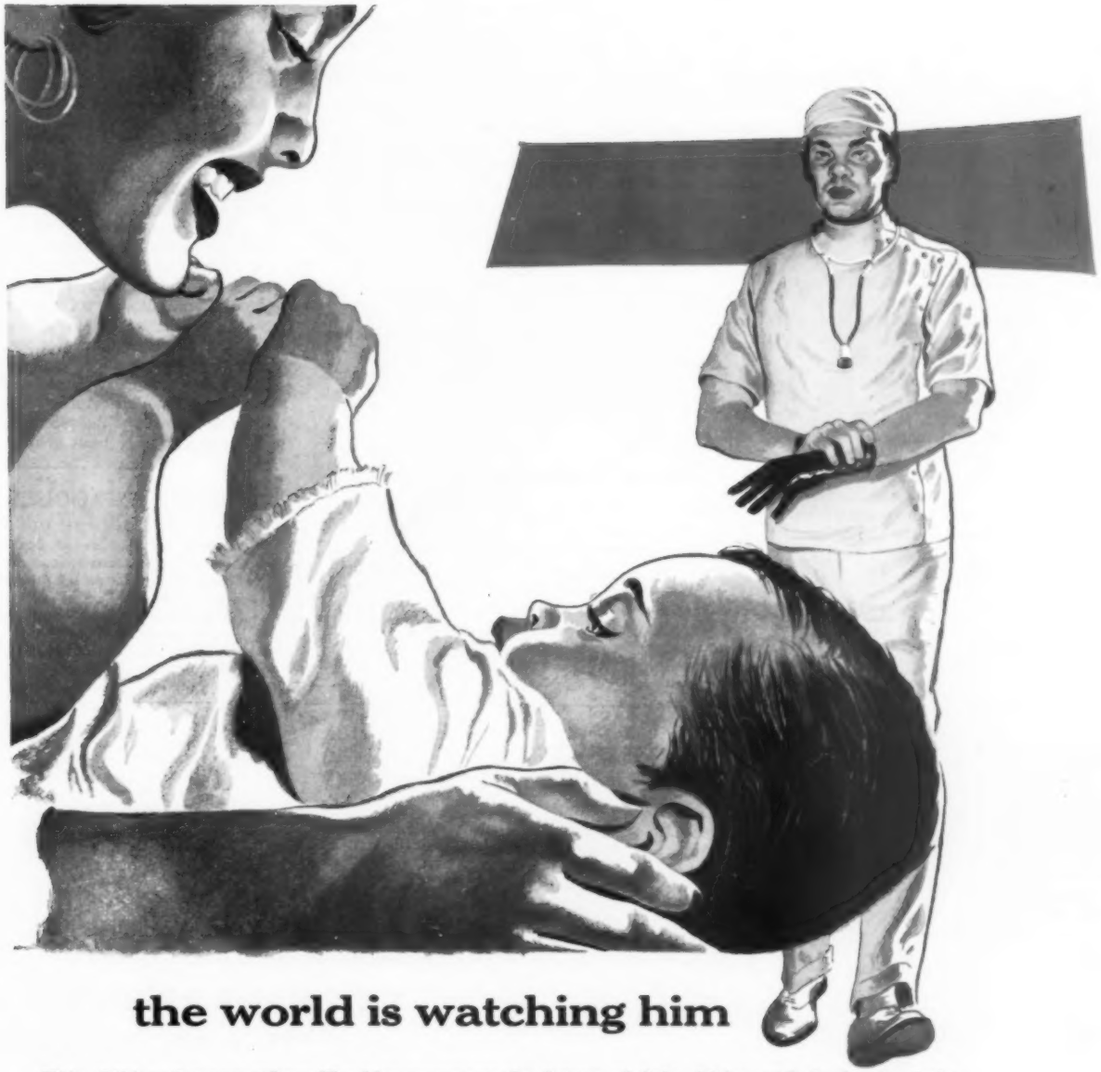


the world is watching him

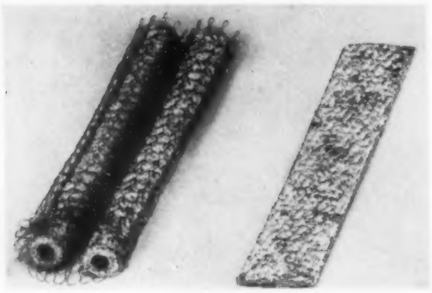
This child and many others like him represent the future of Asia, Africa and the lands of the Pacific. Everywhere throughout this vast area there are new stirrings of light and life. There is a new demand for modern ways that will turn over to machines the work now done by the muscles of men and animals.

This calls for more of the energy that petroleum supplies in so many forms. And here Standard-Vacuum is doing its part. For Stanvac operates wholly within these areas exploring, drilling, producing, transporting and refining oil to meet the growing needs of their huge populations.

Because of what Stanvac is doing, the babies being born today will enjoy a better life than any their fathers have known.

STANDARD-VACUUM OIL COMPANY POWERS PROGRESS

White Plains, New York



New Metex Tray Seal Developed

A new type of gasketing material has been developed by Metal Textile Corporation to reduce excessive leakage across fractionating trays in petroleum refining operations. Tray-Seal is made of pure asbestos fibres and knitted Monel wire which serves as a resilient, protective sheath for the asbestos seal. This eliminates the need for cotton or other conventional binding materials which lose their resiliency under severe operating conditions and often become charred away, leaving openings in the gasket seal.

For other services, where corrosive conditions so indicate, Metex Tray-Seal can be made to order with Inconel, stainless steel, nickel, aluminum or any other metal available in knittable wire form. Thus the resistance of pure asbestos to the corrosive and temperature conditions encountered is the only limiting factor.

Metex Tray-Seal Tapes are available in two forms.

Tray-Seal Dumell—No. 10-998, which is used to seal joints between tray sections and wherever bolts must be passed through the gasket. In this respect it is similar to drop-warp tape.

Tray-Seal Flat—No. 10-999, which is usd to seal the circumference of trays at the support rings and wherever bolting through the gasket is not required.

Tray-Seal can also be furnished on order in gasket form for use on risers, caps and where continuous tapes are not practical.

The first installation of Tray-Seal Tapes was made in 1955 on one tray in a 9 ft. atmospheric tower of pipe still in a large East Coast Refinery.

When the new Metex Tray-Seal Tapes were first installed, leakage tests showed 6% *under* allowable, with no evidence of localized leakage at tray joints. At the end of a year's run total overall tray leakage had risen to only 67% above allowable compared to the 370% previously experienced. Moreover, examination of the tray during tests showed that only 20% to 25% of this total leakage was through tray section joints. The Tray-Seal showed no charring, was still resilient and was not replaced. Tightening of a few of the tray section bolts was the only attention required.

Oil Pays $20 Million In Saskatchewan

Saskatchewan received $20 million in oil revenue during 1956, contrasted with $630,000 in 1952 and $7,950,000 in 1956. Potential oil lands in Saskatchewan include roughly 75,000,000 acres, which present wells occupy two out of every 1,000 acres.

Alberta Production To Fall

The trend of Alberta production allowables is due for a steady downturn over the next few months, with possible interruptions due to seasonal bulges in demand. The reason is the squeeze imposed by rising Saskatechewan production on the east, combined with reduced export volume on the west coast, complicated by the prospect of substantial B.C. domestic production. Ceiling may be 400,000 b/d average for rest of 1957.

Propose Tax Change

An income-tax amendment designed to eliminate, as far as possible, the present competitive disadvantage in development of Canadian oil and gas resources by Canadian companies competing with foreign corporations was placed before Prime Minister John Diefenbaker and Finance Minister Donald Fleming recently in Ottawa, by representatives of the Canadian Petroleum Assn. The association's brief recommends a depletion allowance of 25% of the exploration oil company's share in the gross proceeds of its production of oil and gas. This would extend to those who take the risks on exploration the same depletion allowed the Canadian land owner for over 25 years on his gross royalty income on oil and gas.

Build Biggest Platforming Heaters

Largest heaters ever to be designed for Platforming units are being erected by Procon Inc. at Gulf Oil Co.'s Philadelphia refinery, where two 26,000 b/d units are under construction. More than 100 ft long, the outsized heater installations will each handle two intermediate stages. Procon engineers recommended single heaters for each Platforming unit instead of two smaller heaters for best use of available space and maximum construction and piping economy. The Platforming units are the second and third to be built at the refinery, and are expected to go onstream early next year.

PROCESS and PRODUCT DEVELOPMENT
for the oil-well drilling industry

- **Patentee on the use of Dextran in oil-well drilling fluids, on bacteriostatic carbons for water filtration.**
- **Patent applied for on a nonfermentable starch for drilling fluids.**
- **Authorities on prevention of deterioration of colloidal additives to drilling fluids.**

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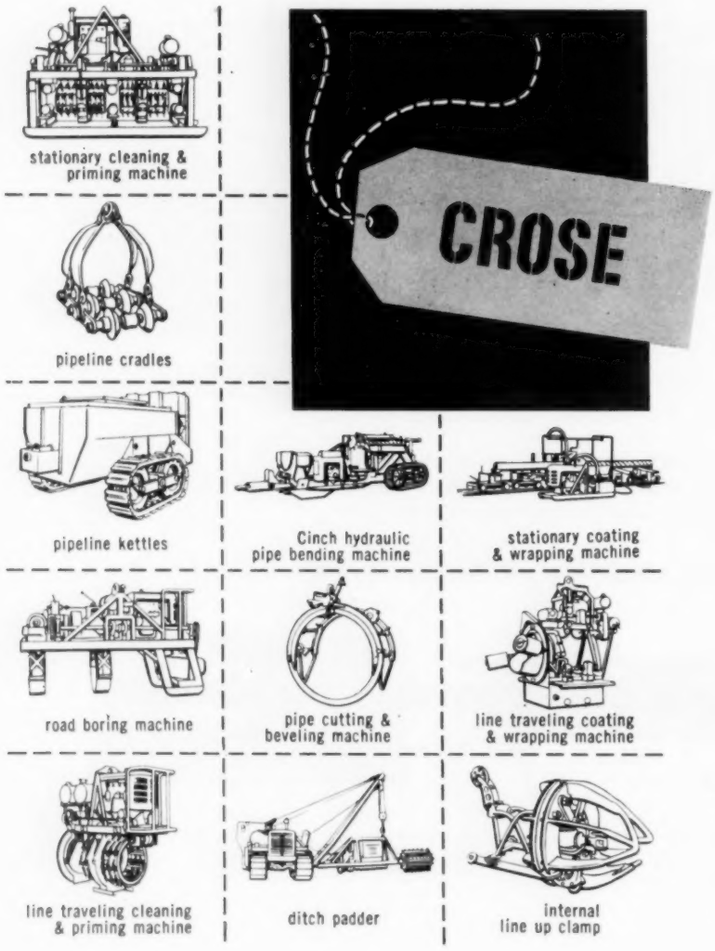

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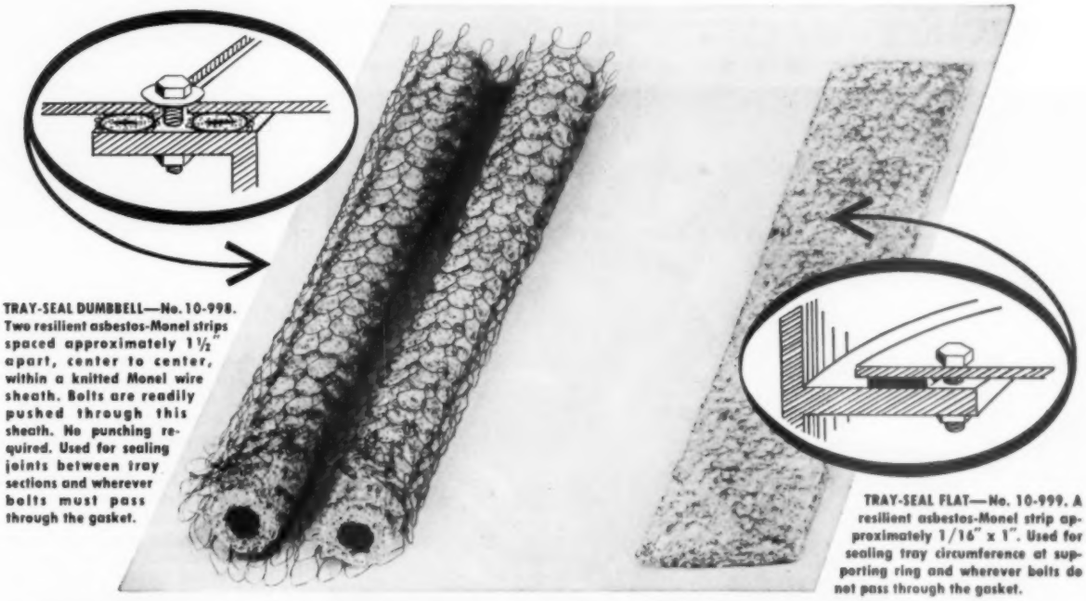

TRAY-SEAL DUMBBELL—No. 10-998. Two resilient asbestos-Monel strips spaced approximately 1½" apart, center to center, within a knitted Monel wire sheath. Bolts are readily pushed through this sheath. No punching required. Used for sealing joints between tray sections and wherever bolts must pass through the gasket.

TRAY-SEAL FLAT—No. 10-999. A resilient asbestos-Monel strip approximately 1/16" x 1". Used for sealing tray circumference at supporting ring and wherever bolts do not pass through the gasket.

METEX TRAY-SEAL GASKETING

Pure Asbestos Fiber and Knitted Monel Wire

Proved by more than two years on-stream service in a large East Coast refinery, Metex Tray-Seal Gaskets[2] have cut leakage previously experienced by as much as 84%. Because it contains no cotton, Tray-Seal showed no charring, even at temperatures of 750° F. No replacements were needed at turn-arounds and tightening of a few bolts was the only attention required.

Installed like conventional tapes, these new gaskets have proved more effective than any other gasketing previously used. Bolts between tray sections are readily pushed through the sheath around Tray-Seal Dumbbell—no punching required. Use Tray-Seal Flat around tray circumference and where un-punched gasketing can be used. Tray-Seal can also be furnished on order as formed gaskets for use on risers, caps and where continuous tapes are not practical.

If you are faced with operating and production problems resulting from excessive tray leakage, write for detailed information... no obligation of course.

1. ®International Nickel Co.

2. U.S. Patent #2,761,203 dated September 4, 1956.

7-074-1

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Belgian Chemical Plant for Italy

The Engineering Division of Société Belge de L'Azote et des Produits Chimiques du Marly (SBA), Liege (Belgium), has secured from the Italian company ANIC a contract for the planning and construction of a styrene monomer plant based on the plans, process information and know-how supplied by the American company, Koppers Co. Inc.

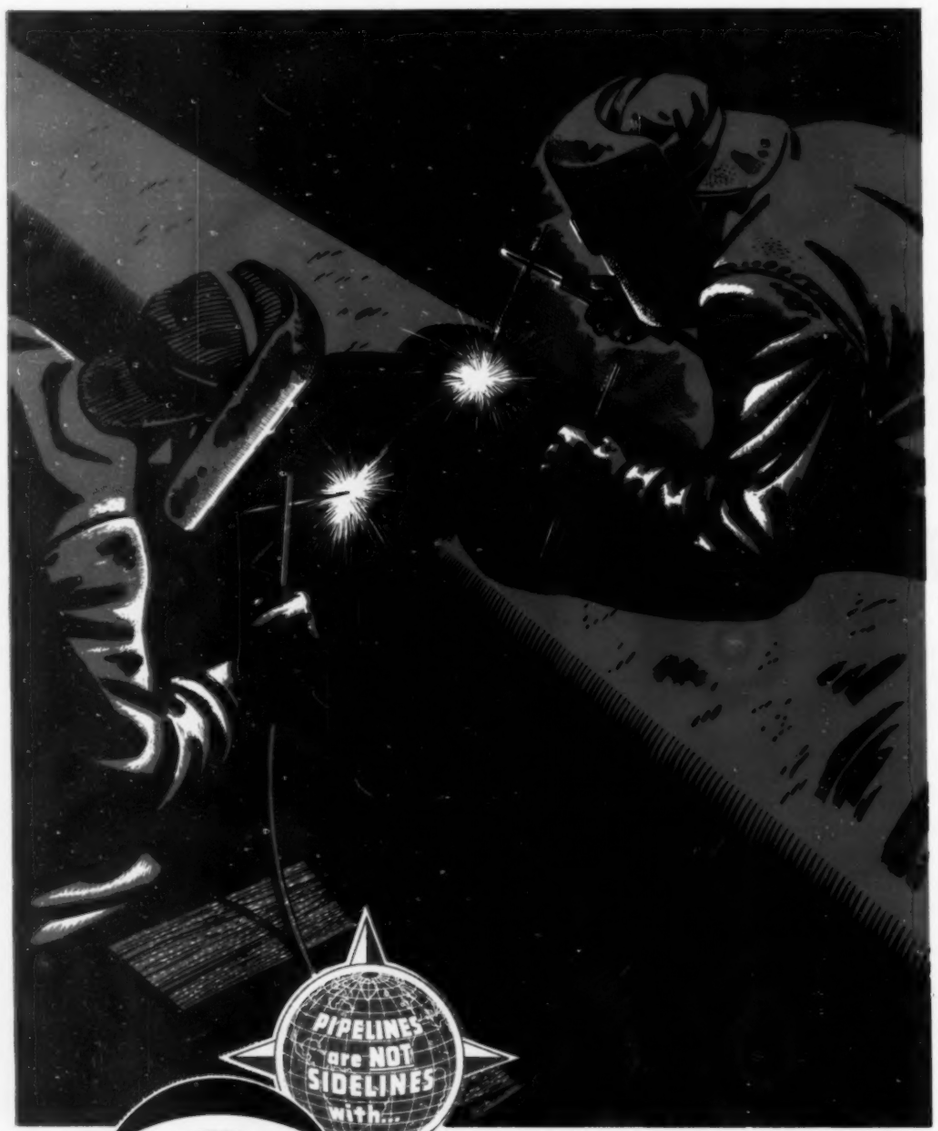
This plant will be installed in Ravenna, Italy, and will have an annual capacity of 14,000 tons of styrene. The styrene will be used for the production of synthetic rubber in a plant which is actually under construction. This is the third styrene monomer plant the Begian company has constructed in Europe, according to the process information supplied by Koppers Co. Inc. The first installation of this type has been in operation since 1956, in Mazingarbe, France, by the French Co. Ethyl-Synthese, while the second one is under construction for Houilleres du Bassin de Lorraine in Carling, France.

Transwestern Elects Chan

Robert M. Chan has been elected to the board of Transwestern Pipeline Co. Transwestern Pipeline Co. is owned jointly by W. K. Warren, of Tulsa; Monterey Oil Co., of Los Angeles; and J. R. Butler and Associates, of Houston. Transwestern proposes to lay a pipeline to transport gas from the Four Corners area being developed in Utah, Colorado, New Mexico, and Arizona to industrial and other users in California.

Heyl Joins OIC

Lawrence Heyl, Jr., has joined the editorial staff of the Oil Information Committee of the American Petroleum Institute, in New York. Before joining API, Mr. Heyl was a member of the public-relations department of the General Foods Corp., White Plains, N.Y., and for several years prior to that was editor of *Texaco Topics*, The Texas Co.'s employee magazine.



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W. R. Huber

1959 Centennial Director

Appointment of W. R. Huber, director of public relations for Gulf Oil Corp., Pittsburgh, Pa., as director of the petroleum industry's centennial celebration in 1959 has been announced today by Frank M. Porter, president of the American Petroleum Institute. Mr. Huber, who has been given leave of absence by Gulf to accept this assignment, will have offices at Institute headquarters in New York.

The centennial, to be observed throughout 1959, commemorates the one-hundredth anniversary of the oil industry, dating from the drilling of the first commercial oil well in the United States at Titusville, Pa., in August 1859.

"Committees representing the oil industry have been at work for more than a year developing plans for the centennial," Porter said. "Ideas and suggestions have been reviewed by the Committee on Centennial Program, and by a working committee composed of oil-industry public-relations executives. Mr. Huber will serve as chief executive officer of the working committee in all aspects of the centennial program."

Mr. Huber joined Gulf Oil Corp. in 1935 as advertising and sales-promotion manager. In 1949, he was named general manager of retail marketing, although he continued to direct Gulf's public-relations program. Since 1954, he has devoted himself entirely to the corporation's public-relations activities.

Fluor to Study Nuclear Distillation

US Department of the Interior, through the Office of Saline Water, has awarded Fluor Corp. Ltd., Los Angeles, contract for study of the applicability of selected combinations of nuclear energy-saline water distillation processes. Objective is to analyze theoretically the economics and technical feasibility of utilizing nuclear energy either as a heat or electrical power source in combination with saline-water conversion distillation processes. Project will be prosecuted at the company's research division, Whittier, Calif.

Jones & Laughlin Makes Oil-Field Pipe

Jones & Laughlin Steel Corp. has started production of electricweld line pipe—a new product for J&L—at its new $8 million electricweld pipe mill at the Aliquippa (Pa.) works. Most modern improvements have been installed on the new mill. Built by McKay Machine Co., Youngstown, Ohio, the plant has been designed for high-speed, continuous production of quality electricweld line pipe for many applications—including gathering, distribution, and transmission lines for natural gas and crude oil; and product lines from refineries and petrochemical plants.

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Crescent Gas Development

A permit for export of natural-gas reserves underlying its Many Island Lake field in southeastern Alberta has been granted by the provincial government to Crescent Corp. With a take-or-pay requirement becoming operative this October at a starting price of 10¢ a thousand cubic feet, the gas will be sold to Saskatchewan Power Corp. for distribution principally to the cities of Swift Current, Moose Jaw, and Regina. The contract calls for sale of more than 210 billion cubic feet of gas over a 20-year period. Crescent and Britalta Petroleums Ltd. each own an undivided one-half interest in the Many Island Lake field, which has gross recoverable reserves estimated by DeGolyer and MacNaughton of more than 439 billion cubic feet.

Canadian Offshore Shipments Down

No relief for Trans Mountain Oil Pipe Line Company can be expected from President Eisenhower's declaration on oil import exemptions. According to Trans Mountain's own forecasts, no offshore traffic is visible for the next few months except for possible emergency orders. Volume expected for second half 1957 is around 150,000 b/d average, contrasted with 183,816 b/d in first half.

Devonian Reef Extended

A significant southern extension of the Devonian oil-bearing reef is indicated by the follow-up well to the White Rose-C. & E. Innisfail No. 1-16 discovery. Follow-up White Rose-C. & E. Innisfail No. 11-3-35-1, is now drilling 1½ miles southeast of the discovery, and has encountered the Devonian reef 10 ft higher than the discovery well, which found 148 ft of oil-bearing Devonian reef. The top 10 ft of the reef has been tested in the extension well, and the results indicate the presence of a thin gas cap associated with the oil. Casing is being run in the hole, after which the well will be deepened and the remaining reef section tested.

F. E. C. Jenkins

Tretolite Moves Jenkins to The Hague

Tretolite Co. division of Petrolite Corp. has announced transfer of Frederick E. C. Jenkins from the St. Louis office to The Hague, The Netherlands. Mr. Jenkins has been assistant manager of technical services. In his new position, he will be affiliated with the European division of Petrolite Corp., Petrolite Ltd. He will serve as technical service engineer, specializing in the applications of Tret-O-Lite demulsifiers and Kontol corrosion inhibitors throughout Europe and the Middle East.

Peruvian Well Produces

Cia. Peruana's second discovery well, Maquia No. 2, came in at about 265 b/d from Upper Cretaceous. The company is owned by local capital and three German companies, one of which is partly owned by Standard of New Jersey.

Canadian Offshore Work

Exploration in a group of small islands, known as Gulf Islands, between Vancouver and Victoria, B.C., in the Gulf of Georgia has been launched jointly by three Western Canadian companies. Canadian Collieries Ltd. is participating with Pacific Petroleums Ltd. and Charter Oil Co. Ltd.

Leeds & Northrup of Canada

Organization of Leeds & Northrup Canada Ltd., wholly owned subsidiary of Leeds & Northrup Co., Philadelphia, has been announced by I. Melville Stein, chairman of the new company and president of parent organization. Located at 61 Industry St., Toronto 15, the firm will manufacture and distribute the electronic controls and measuring instruments formerly supplied from the United States.

UOP's Bloch to Receive Chemists' Award

Dr. Herman S. Bloch, deputy director of refining research for Universal Oil Products Co., has been selected to receive the 1957 Honor Scroll of the Chicago chapter, American Institute of Chemists. A jury of six members of the Chicago chapter unanimously chose Dr. Bloch from a list of 10 nominees. He is the second man from UOP to receive the honor—the late Professor Vladimir Ipatieff having been awarded the initial scroll in 1942.

Mexican Reserves 3.3 Billion

Reserves are given as 3.3 billion barrels by President Cortinez. Imports' cost is up sharply to 616 million pesos; exports down to 19 million barrels during past year. Consumption rose 17.2% to 75 million barrels. Criticism of Pemex, government monopoly, is rising, but no opening to foreign capital is seen.

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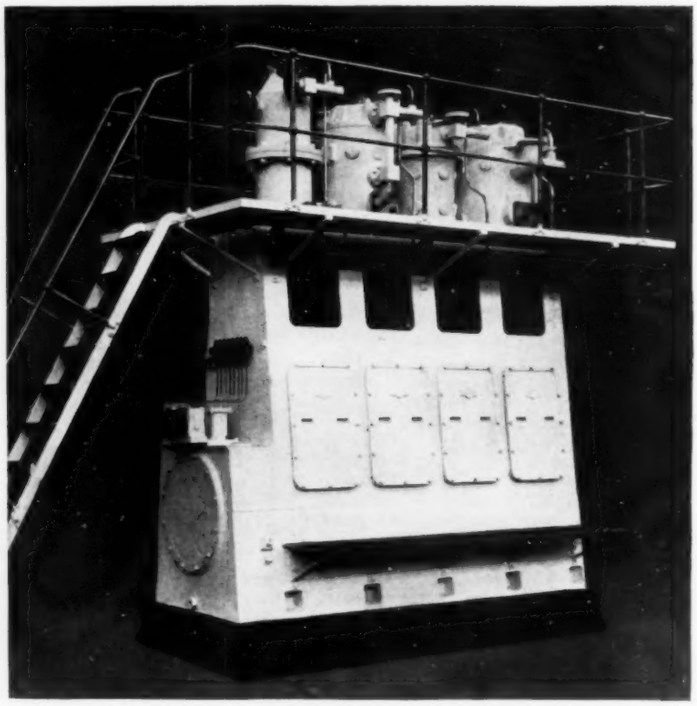

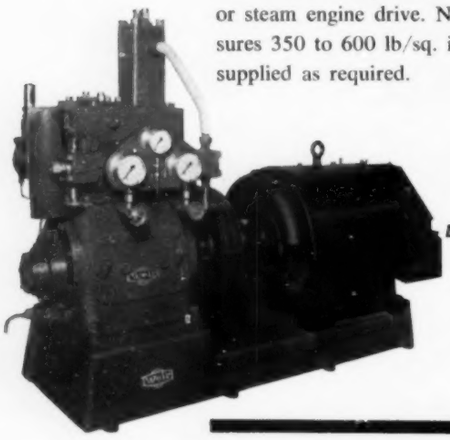

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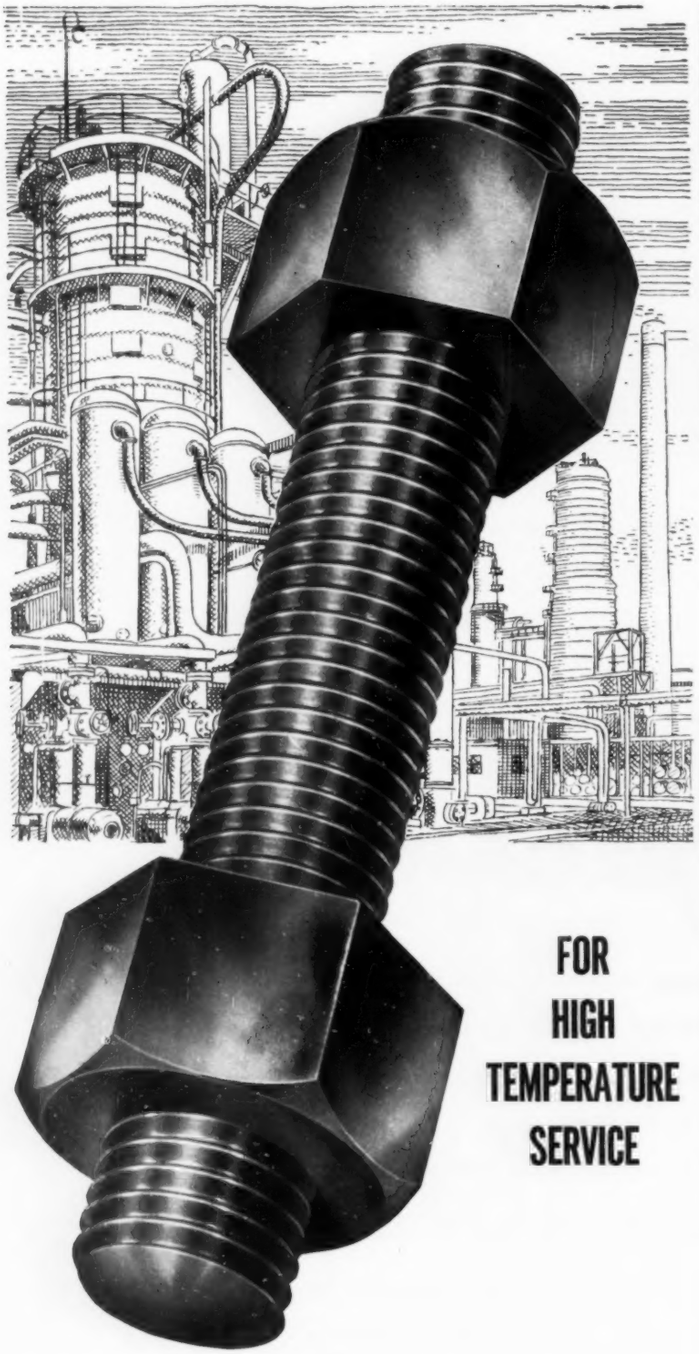

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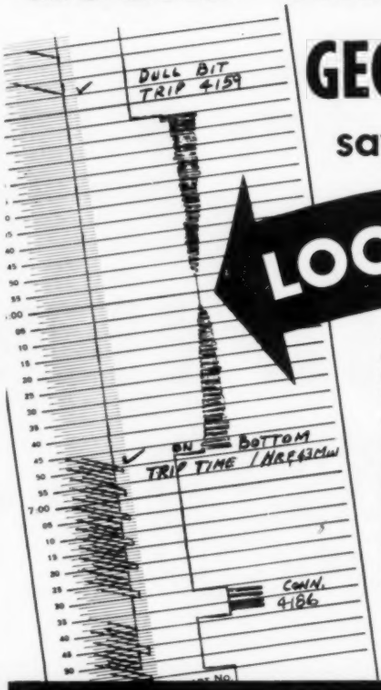

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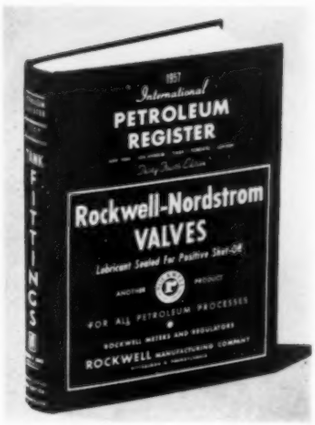

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Greek Exploration Stops

Israel Mediterranean Petroleum and Pan-Israel Oil Co. have given up on the island of Zante. They took half interest in a concession from Martin Lerman of St. Louis after guaranteeing to spend $150,000 and drill 15,000 ft. The company gave up after 7,000 ft without results.

Jersey Standard Enters Iran

Standard Oil Co. (New Jersey) has begun talks with Iran concerning a concession near the areas recently taken by AGIP, the Italian govt. company. Jersey will pay a bonus to the govt., rather than accept a participation by the government as AGIP did.

Pechelbronn, Shell, Bid In Sahara

The list of companies bidding in the Sahara has risen to 8 with Pechelbronn Oil Co. applying for exploration rights in the Sahara. The company previously made a joint bid with Cities Service through PREPA.

Shell Group also has made a bid on acreage, in addition to that which it already has through its 35% participation in Cie. de Recherches et d'Exploition du Petrole au Sahara and its 65% in Cie. des Petroles d'Algerie.

Refinery Bid In Guatemala

Breaux Bridge Oil Refining Co., of Louisiana, has requested permission to build a 2,000 b/d refinery at Santo Tomas, on the Caribbean coast. There is no production in Guatemala yet, although an extensive exploration campaign is underway. Breaux Bridge is not among the explorers, but under the new oil law refining rights may go to persons not holding exploration rights.

New German Refinery By Tidewater

A refinery and petrochemical plant is planned by Tidewater Oil Co. at Dinslaken, lower Rhine area. The company has an interest in production from the Neutral Zone (Saudi Arabia-Kuwait section) which would presumably supply the crude.

French Oil Investment Rising

French sources estimate oil investment reached US$190.5 million during 1956 in exploration and production. An additional US$166.7 million was invested in other industry phases. 1957 exploration expenditures are estimated to reach US$142.8 million and may reach US$238.1 yearly in coming years.

Two new refineries are planned, one at Strassbourg and one at Algiers.

Oil Largest US Investment Abroad

According to US Department of Commerce, private American investors, in the period 1953-55, each year sent abroad for petroleum enterprises an average of $513 million net (new capital plus undistributed earnings). Nongovernment investments by Americans for all types of enterprises in the same period averaged $1.45 billion annually. Thus petroleum accounted for about 35%. Next came manufacturing enterprises, which received annually $459 million, just under 32%. However, petroleum actually accounted for more than 35%, as oil figures for some countries are included with "other industries." Mining and smelting accounted for an annual nongovernment investment abroad of $182 million, and other industries for $297 million. Figures for 1956 probably will be larger.

Oil investments in Canada far exceeded those in the Middle East, which are contained in figures for "the rest of the world," as shown by the following table:

AVERAGE ANNUAL NONGOVERNMENT AMERICAN INVESTMENT FOR OIL ABROAD—1953-1955 (Millions of Dollars)

Area	*Petroleum*	*Total*	*Petroleum, % of Total*
Canada	201	613	32
Western Europe	76	273	27.8
Australia	(a)	61	
Japan	(a)	19	
Total above area	277	967	28.6
Latin America	70	266	26.3
Argentina	(a)	18	
Brazil	5	32	15.6
Chile	(a)	4	
Colombia	-3	16	
Mexico	1	36	2.7
Peru	(a)	17	
Venezuela	40	87	45.9
Union of South Africa	-3	21	
Western European Dependencies	48	68	70.6
Rest of the world	121	129	93.8
	513	1,451	35.3

(a) Included with "other" industries.

2nd Qum Discovery

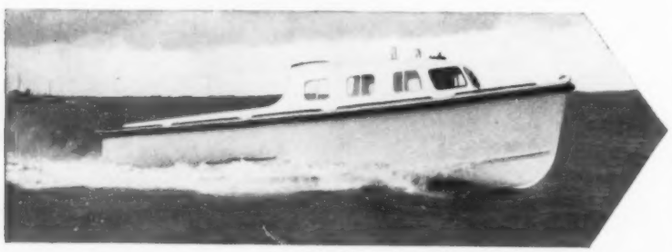
A second discovery has been made in the Qum area, about 1½ miles west of the original well which flowed wild for several days at rates estimated over 100,000 b/d. No. 6 Alborz encountered pay formation at 8,754 ft.

Brazil's 2nd Alagoas Wildcat

Second wildcat discovery announced by Petrobras is in state of Alagoas at 5,136 ft to 5,146 ft. Production was about 900 b/d 41 API gravity crude. Other wildcat in old producing region of Bahia Bay tested about 1,200 b/d.

Full speed ahead for 35 . . .

This is a 32 ft. general purpose light alloy launch with accommodation for 35 passengers—one of a number on delivery to The Shell-B.P. Petroleum Development Company of Nigeria Limited. She's powered by a Perkins S.6 Diesel engine and designed for fast, reliable transport of Marine personnel *especially in tropical areas.*



Built on our patented "Two-way-tension" system of construction, this class of launch has exceptional strength and ruggedness. Ease of maintenance and economical running are additional advantages; and the light alloy hull is immune to teredo worm attack, rust, wet and dry rot, or deterioration in extreme climatic conditions.

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AP20

NOTICE

The National Iranian Oil Company hereby informs all interested persons and Companies that, in accordance with the provisions of the Iranian Petroleum Act of July 31st, 1957, any inquiries, requests for information, or proposals of any nature whatsoever in connection with the performance of petroleum operations in Iran must be addressed direct to:

The Chairman of the Board of Directors
National Iranian Oil Company
Avenue France
Tehran, Iran

Any communication made through other channels shall have no effect.

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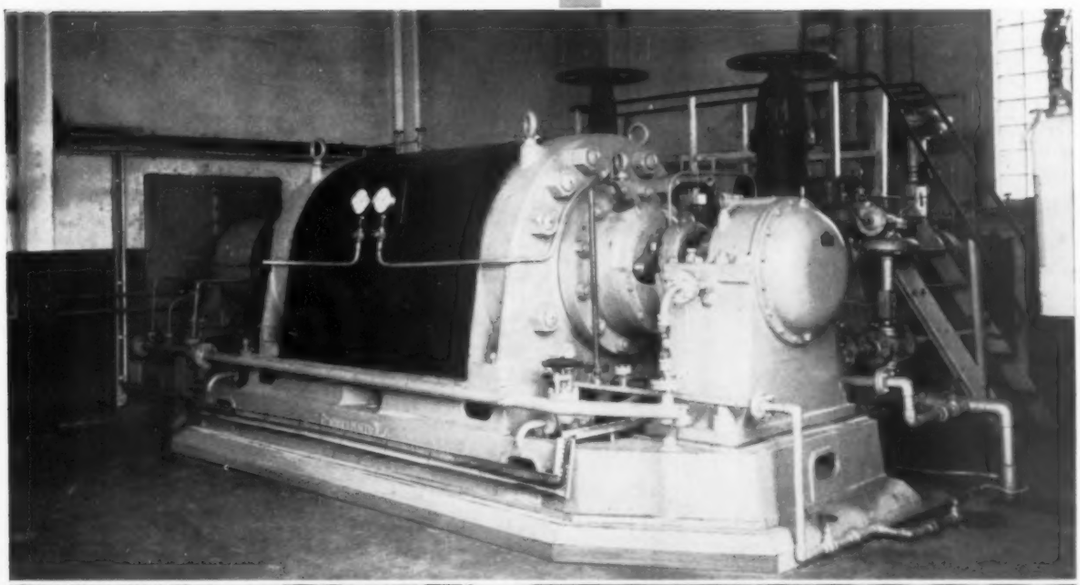

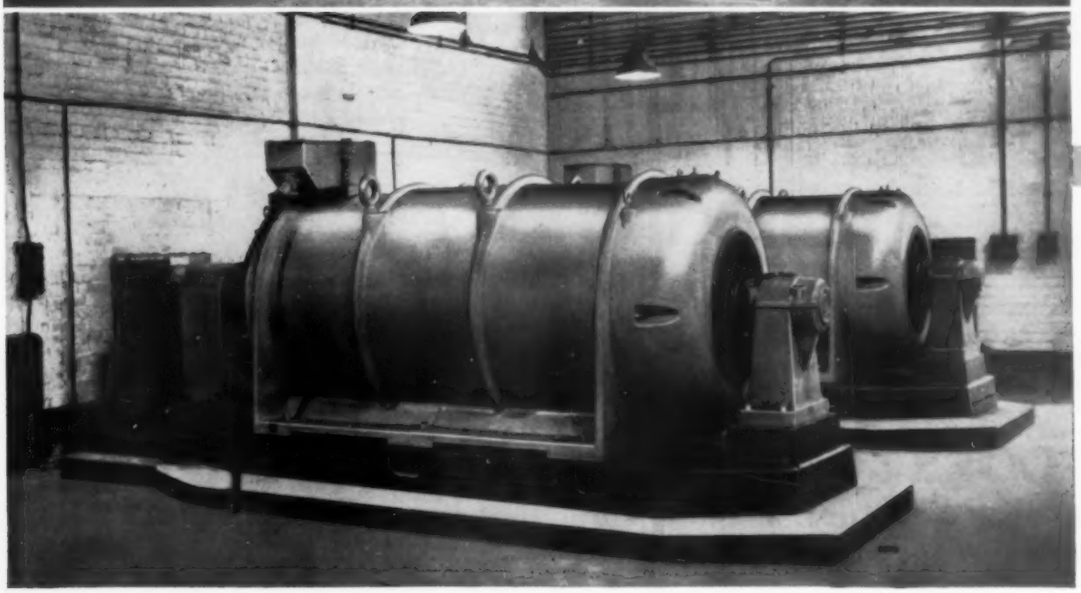

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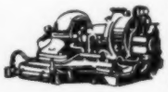

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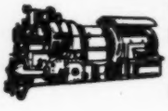

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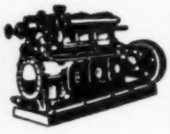

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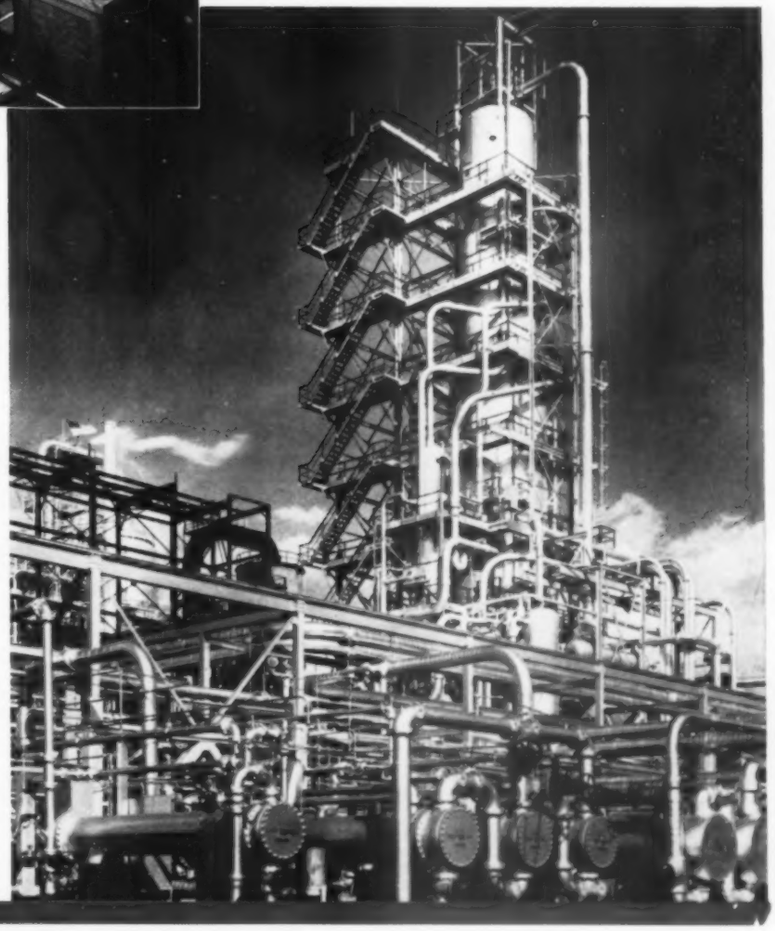

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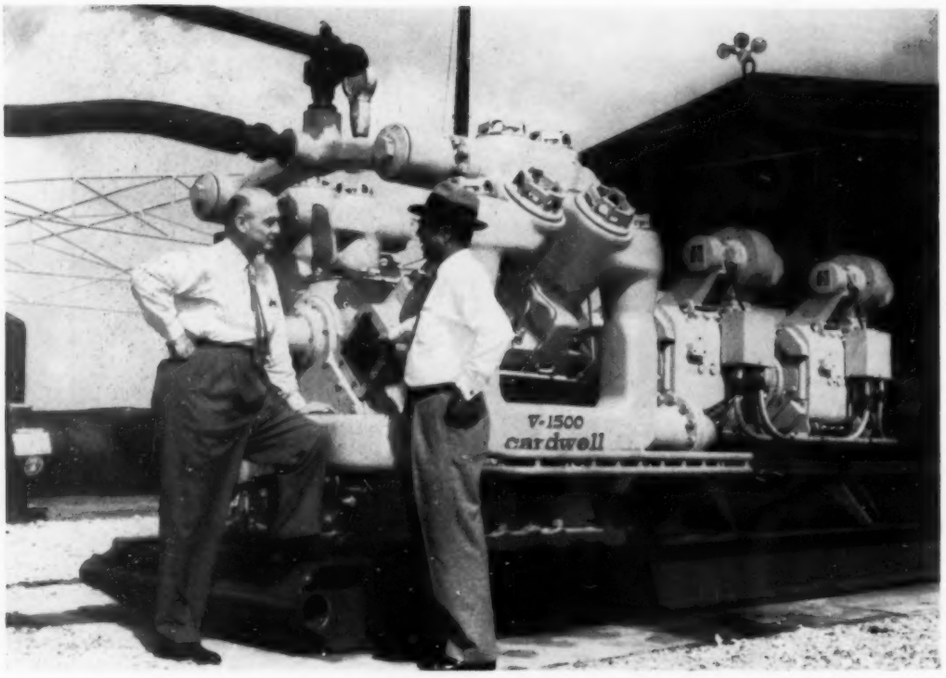

New Cardwell Pump Displayed

A new innovation in mud pump design for drilling oil wells has been announced by the Cardwell Manufacturing Co. Cardwell's new V-1500 Mud Pump is approximately ⅓ the weight of any mud pump in the large horsepower class. The new pump is capable of operating under pressures of 3500 pounds per square inch and delivering volumes up to 1114 gallons per minute.

Among the unique features of the new V-1500 pump are such engineering innovations as four-cylinder, V-type construction, high speed operation and two-piece crankshaft. The pump is of plunger design eliminating the pistons and fluid liners commonly associated with mud pumps.

In addition to materially reducing weight in their pump, Cardwell has also reduced the overall size of the pump. By reducing the space required to accommodate the unit, Cardwell officials pointed out that its use in marine drilling applications would prove to be a valuable asset in saving expensive deck space on off-shore barges and platforms.

The V-1500 was unveiled at a press conference in Houston, Texas, Tuesday, September 17th. At that time, J. T. Tucker, general manager of sales for Cardwell, stated, "For many years the oil well drilling industry has had need for a high pressure, high volume, dependable, lightweight mud pump. Jet bit and big hole drilling practices have created a demand for mud circulating rates which must be met to get maximum efficiency from today's improved tools.

Hydroisomerization to Upgrade Gas

Gulf Oil Corp. has announced contract to Procon Inc. to install facilities to process approximately 10,000 b/d light gasoline at its Port Arthur, Texas, refinery. Facilities will include fractionation equipment and a pentane isomerization unit. The hydroisomerization process employed is based on developments in the laboratories of both Gulf Research & Development Co. and Universal Oil Products Co. It is believed this will be the first commercial unit to use a platinum catalyst for isomerizing pentanes.

ARAMCO Gas-Injection Plant

Construction of the new Ain Dar gas-injection plant, the second such installation in Saudi Arabia, was begun recently by Arabian American Oil Co. The Abqaiq plant went into operation three years ago. The new plant will increase the ultimate oil recovery of the Ain Dar and Shedgum fields, in addition to conserving gas produced in those areas. It will gather gas from the gas-oil separators of Ain Dar No. 1, No. 2, No. 3, No. 4, and Shedgum. With associated facilities, the gas-injection plant will represent an investment of $43 million in operation. It is estimated that the total amount of gas to be injected will reach 200,000,000 cu ft per day.

The centrifugal gas compressors to be used in this operation were built by Clark Bros., of Olean, N.Y. Brown and Root, Houston, has the design contract.

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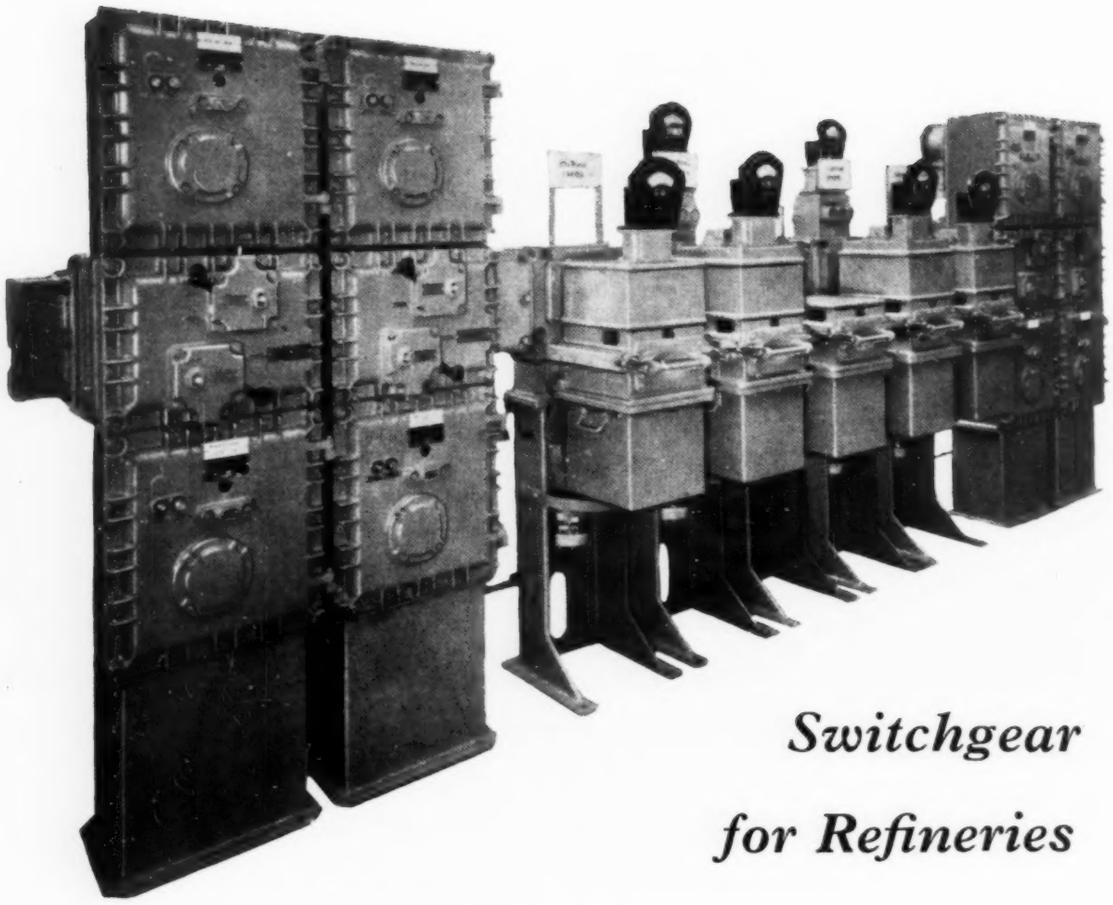

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BJ South American Representative

Jack Smith, export representative for Byron Jackson, Tools, Inc., has begun a 100-day tour of the major Central and South American oil centers and fields. He carries up-to-the-minute specifications on Byron Jackson equipment especially Byron Jackson's new Red Top Centralizers.

Phillips to Join Nuclear Study

Four major USA companies—one of them Phillips Petroleum Co.—have established a group of scientists and economists to study the technical and economic feasibility of building and operating a nuclear testing center with private capital. Announcement of this nuclear test center study group was made jointly by the heads of the cooperating companies. They are James F. Clark, president of ACF Industries Inc.; Edgar F. Kaiser, president of Kaiser Engineer; Courtland S. Gross, president of Lockheed Aircraft Corp., and K. S. Adams, Phillips chairman.

Dresser at All-Time High

Reaching an all-time high and continuing upward trend of several years' duration, Dresser Industries Inc. reported sales of $71,210,878 and earnings of $5,217,010 in the 3rd 1957 quarter. Increase is noteworthy in view of the lag in domestic drilling, one of the company's principal markets for equipment and services.

BP Forms Petrochemical Department

In view of British Petroleum Co.'s increasing interest in petroleum-chemicals manufacture, the company is establishing a new department with responsibility for this field—a separate organization from the company's refineries and technical department. It will be headed by D. G. Smith as general manager, and Dr. D. A. Howes as assistant general manager.

Hans Szepanek

European Technical Representative

Baker Oil Tools Inc., has appointed Ing. Hans Szepanek, Celle, Germany, as technical representative for West Germany and Austria. He will also act in a similar capacity in such other European countries as time and circumstances permit.

Mr. Szepanek spent seven years with Gewerkschaft Elwerath, in Germany, prior to joining Baker in May of this year. Since that time he has been trading extensively in the United States at Baker's Houston and Los Angeles facilities, as well as in the oil fields of Texas, California, and New Mexico.

FAGRO GmbH, Hannover, will continue to function as sales representative for Baker products in West Germany and Austria, regardless of whether the products are manufactured in Germany or the United States. FAGRO will also continue to furnish technical assistance when required.

EARL W. MAYO

Earl M. Mayo, Editor Emeritus of World Petroleum, died recently at Westport Sanitarium. He was 83. He leaves his son, Earl W. Mayo, Jr., his second wife, Mrs. Morrison Mayo, and a brother, George Mayo.

Mr. Mayo had been associated with the Palmer Publications since its inception and was active until recently in World Petroleum, which he founded with Russell Palmer in 1930. He was editor and founder of Sugar, a magazine in the Palmer Publications group, and his son, Earl W. Mayo, Jr., is still editor of that magazine.

He was widely known in the petroleum industry through his long association with World Petroleum, and had traveled throughout the world in oil. His friends were many in all ranks of his industry, including such prominent members as Sir Henri Deterding, chairman of Royal Dutch-Shell, and Sir John Cadman, chairman of Anglo-Persian Oil Co. (now British Petroleum).

A graduate of Cornel University in 1894, he started there as an English instructor in that same year. The next year he became a reporter for The New York Sun.

In 1898, Mr. Mayo became editor of McClure's Syndicate, and the next year went on the staff of the Sunday New York Herald (now Herald Tribune). He subsequently traveled in Europe and elsewhere as a correspondent of McClure's, Outlook, World's Work and other publications and later, of course, for World Petroleum.

SEG Has International Theme

"International Geophysics, both Practical Applications and Pure Science" will be the dominant theme of the 27th Annual Meeting of the Society of Exploration Geophysics (SEG) in Dallas, Texas, November 11-14, 1957.

Three papers on practical geophysical problems in oil exploration in French North Africa will be given by French geophysicists, and one on Turkey will be presented by S. Diker, of Ankara, Turkey.

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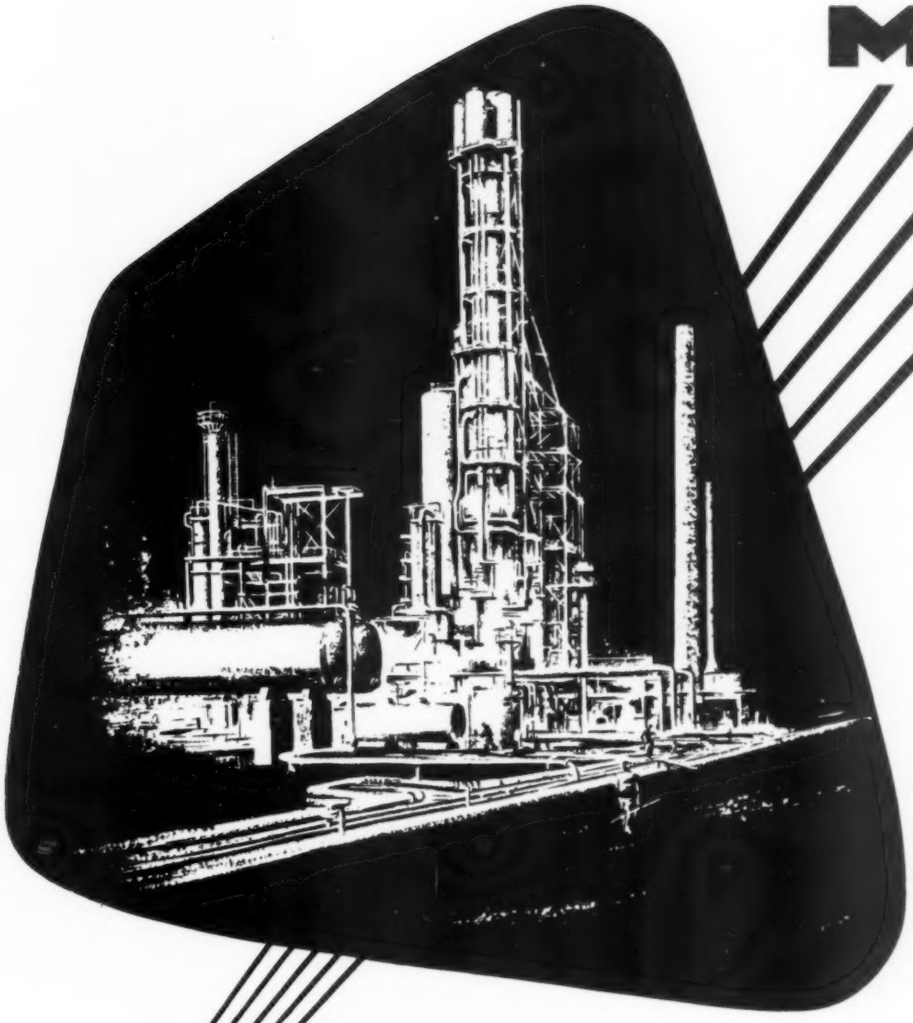

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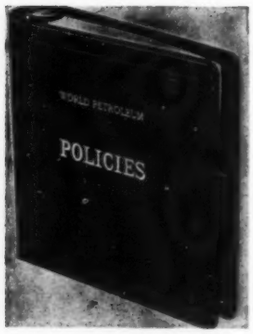

WORLD PETROLEUM POLICIES

It is An exact chronological account with quotations from original sources of factors, statements and opinions affecting the petroleum industry's relations with the public and governments, both here and abroad, **KEPT UP TO DATE.**

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PART VIII	**The Suez Crisis—1956-1957** **"ERA OF THREAT"** **1st Quarter Supplement 1957** **2nd Quarter Supplement 1957**
PART VII	**Postwar Problems and Policies—1946-1956** **"ERA OF EMERGENCY"**
PART VI	**World War II Policies—1942-1945** **"ERA OF COOPERATION"**
PART V	**Nationalization Policies and Foreign Oil—1936-1941** **"ERA OF RESTRICTION AND INVESTIGATION"**
PART IV	**USA Oil Conservation Policy—1924-1935** **"ERA OF SURVIVAL"**
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The entire cost of this volume is $195, including revision service for one year. After that time the revision service can be continued for $52.50 yearly, including all costs. It may be received for your inspection without obligation.

WORLD PETROLEUM POLICIES

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Creole Petroleum's TIA JUANA
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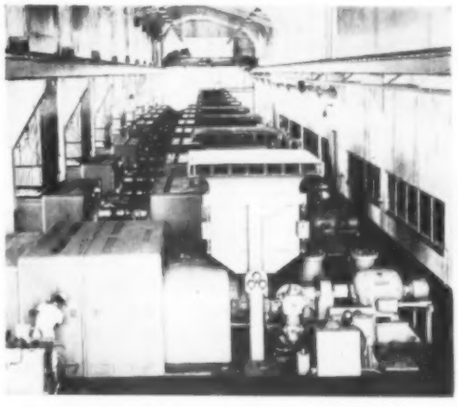
Why General Electric is proud of Creole Petroleum's "Gas Turbine Island"

Seven miles out in Venezuela's Lake Maracaibo stands a unique example of the petroleum industry's constant search for new and better methods of conservation—Creole Petroleum Corporation's Tia Juana No. 1 Conservation Plant. Here, ten General Electric gas turbines drive compressors to return previously flared gas under pressure to the underwater oil field, thus increasing Creole's oil yield.

Accumulated data prove that the performance of the ten G-E gas turbines has exceeded all expectations. In the first 27 months, during which time the machines accumulated in excess of 170,000 hours, availability of individual turbines was 95 percent. In fact, unscheduled gas turbine downtime has never caused the plant to shut down. Originally planned to pump 137 million standard cubic feet of gas per day, the platform has pumped as much as 170.8 million cubic feet per day on a weekly average.

Versatile, economical, compact G-E gas turbines are already at work in a diversity of applications. Why not check into the advantages they can bring to your operation? Consult the General Electric representative nearest you. *International General Electric Co., Dept. 57-36E, 150 East 42nd Street, New York 17, N.Y., U.S.A.*



PUMPING 24 HOURS A DAY, compressors driven by General Electric gas turbines maintain pressure in Creole Petroleum's vast oil fields under the waters of Lake Maracaibo, increasing the recovery of oil and conserving large volumes of gas for future use.

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Brownsville Synthetic Plant Closed

The world's first plant to make synthetic gasoline and chemicals from natural gas in commercial quantities will close down, Amoco Chemicals Corp. has announced. The Brownsville plant cannot make gasoline and chemicals from natural gas at present market prices as cheaply as they can be made by other processes, according to Jay H. Forrester, president of Amoco Chemicals, a Standard Oil Co. (Indiana) subsidiary. It was orginally completed in 1950 by Carthage Hydrocol Inc., aided by a Reconstruction Finance Corp. loan of $18.5 million. Process and mechanical problems forced Carthage to shut it down in 1953. An affiliate of Standard Oil Co. (Indiana) took over in 1954. Attempts to work out profitable operations have been continued until today.

Bringing the facilities into production has taken more than a year longer than forecast in 1954, plus much higher capital investment and operating costs than were forecast. Rising costs of construction, equipment, labor, and raw materials have contributed to an increasingly unfavorable picture.

Completed in 1950, this plant was designed to take the raw chemical mixture, separate it into its basic components, and refine the chemicals into marketable products. The basic products were alcohols, acids, aldehydes, and ketones. These chemicals are used widely in the manufacture of paints and lacquers, plastics, rayon, anti-freeze, drugs, cosmetics, and numbers of other chemical products.

Though completed in 1950, the synthesis plant was plagued by process and mechanical problems. It never achieved more than 30% operating status. In June 1953, it was shut down by Carthage Hydrocol. The original owners took their losses and turned the plant back to the RFC, which held a mortgage, then paid down to about $17.5 million, on the facilities.

Champlin To Drill In Panama

Two wildcats will be drilled by Champlin Oil & Refining Co. in the Laguna de Chiriqui region. The first will be offshore in about 120 ft of water. The other is also located offshore, but in less depth. Kerr-McGee Oil Industries Inc. and Southland Royalty Co. each has a 25% interest.

Honduras Concessions Areas Opening

British Honduras Gulf Oil Co. was to give up all but about 1,000 square miles on October 20. The company drilled two dry holes, and will only retain the southern half of the country. Gulf's rights cover the entire British Honduras at present.

Yugoslavia Reports New Field

After having announced the discovery of an oil field at Pivnica two months ago, the Yugoslav press shortly followed with the discovery of another field at Osecovo.

At Pivnica, two 10-ft oil-bearing layers were found—at 1,742 ft and at 1,772 ft. At Osekovo, a 40-ft layer was pierced at 3,156 ft. The productive area is estimated at 3.08 square miles. Experts believe other layers may be found at 6,560 ft and at 7,545 ft.

U. S. Demand Down

The three month period of June-August showed a gain in oil demand of only 0.7% over last year's same period. This was about 3.5% below the predicted levels, amounting to 325,000 b/d. Demand for the first 8 months is about 4.4% over a year ago, but due to the abnormal export trade that developed during Suez.

Barnwell Honduras in 51 Million Acres

Barnwell Offshore Inc., Shreveport, La., has acquired a one-half interest in a 51-million-acre oil, gas, and mineral concession in Honduras, Central America. Covering both land and offshore area, the concession lies in the departments of Comayagua, Cortes, Atlantida, Colon, the Mosquitia territory, (now Gracios A Dios), the Bay Islands, the continental shelf tidelands and territorial seas on the Caribbean—bordered on the west by Guatemala and on the east by Nicaragua. It will be owned in conjunction with Compania Petrolera Hondurena SA, of Honduras. Preliminary geological work has been done on the concession, and it is reported several likely structures have been found.

A well reported drilling below 12,500 ft offshore near Punta Gorda in Nicaragua is located not far east of the easternmost boundaries of the Barnwell concession. A well is also reported preparing to drill in southeast Guatemala just west of the state of Cortes and the western boundary of the concession.

R. S. Barnwell, Jr., president of the firm, has stated that, as soon as all the legal requirements in connection with the acquisition of the concession have been completed, plans will be developed for an exploration program. It is expected this program will involve the use of the company's mobile offshore drilling barge now under construction in the LeTourneau yards, Vicksburg, Miss. Delivery of the barge was expected in September.

ENI May Enter Libya

The Italian government's oil company, Ente Nazionale Idrocarburi, is among the new applicants for concessions in the Fezzan district of Libya. No new concessions are being granted at present, according to the govt.

Something new!

For the first time, oil laws and/or concession arrangements in the major countries of the world, comprising over 40 different nations, have been translated, condensed, and packaged into a single leatherbound, loose-leaf volume. The information is continually revised and maintained up-to-date by substitution of the loose-leaf pages to give you current information necessary to oil operations in almost any country of the world.

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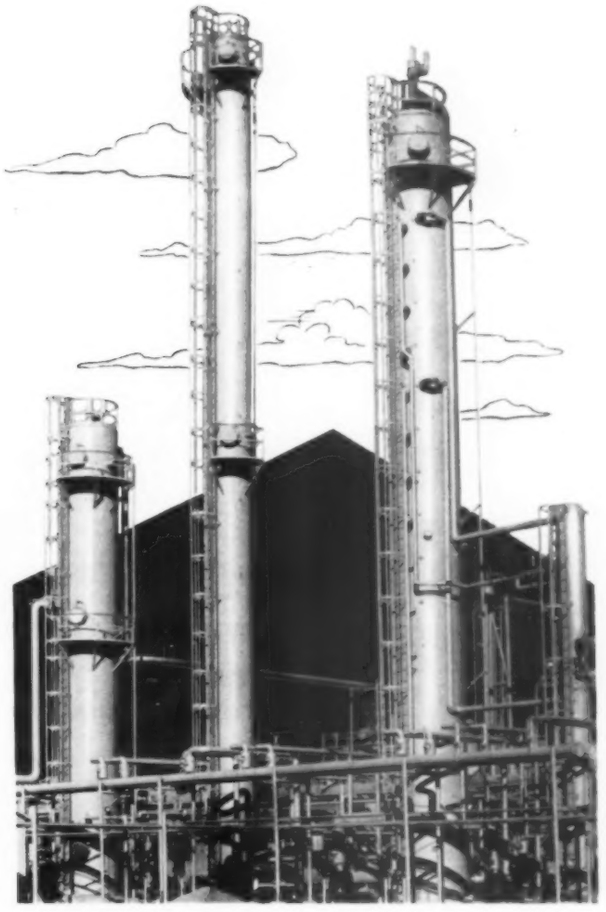

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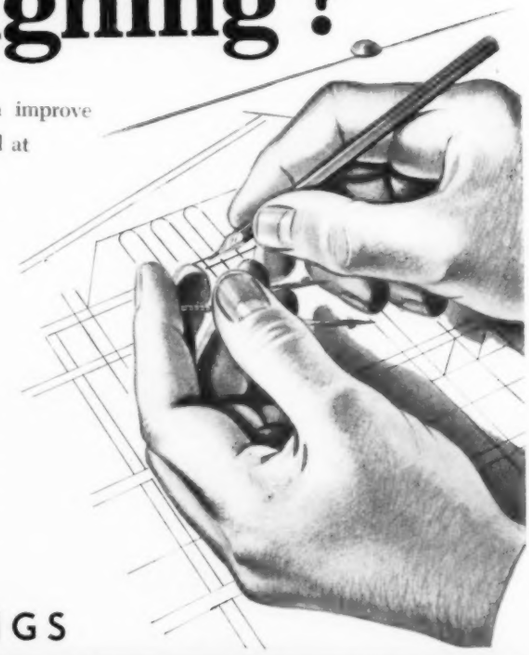

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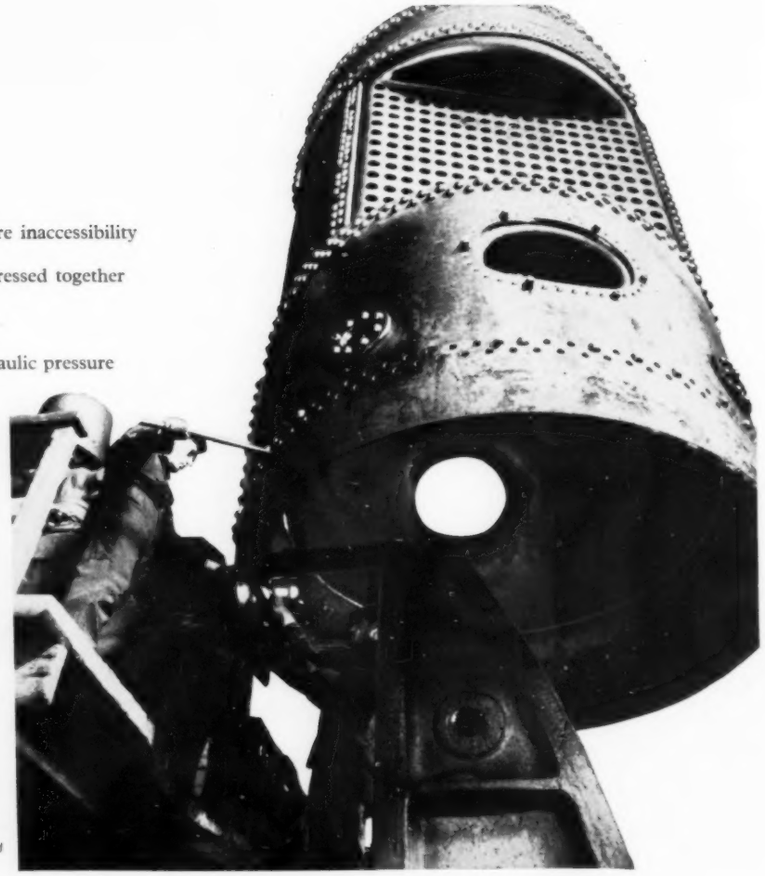

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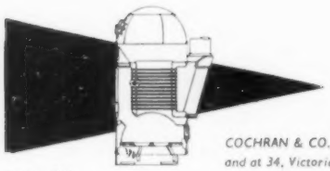

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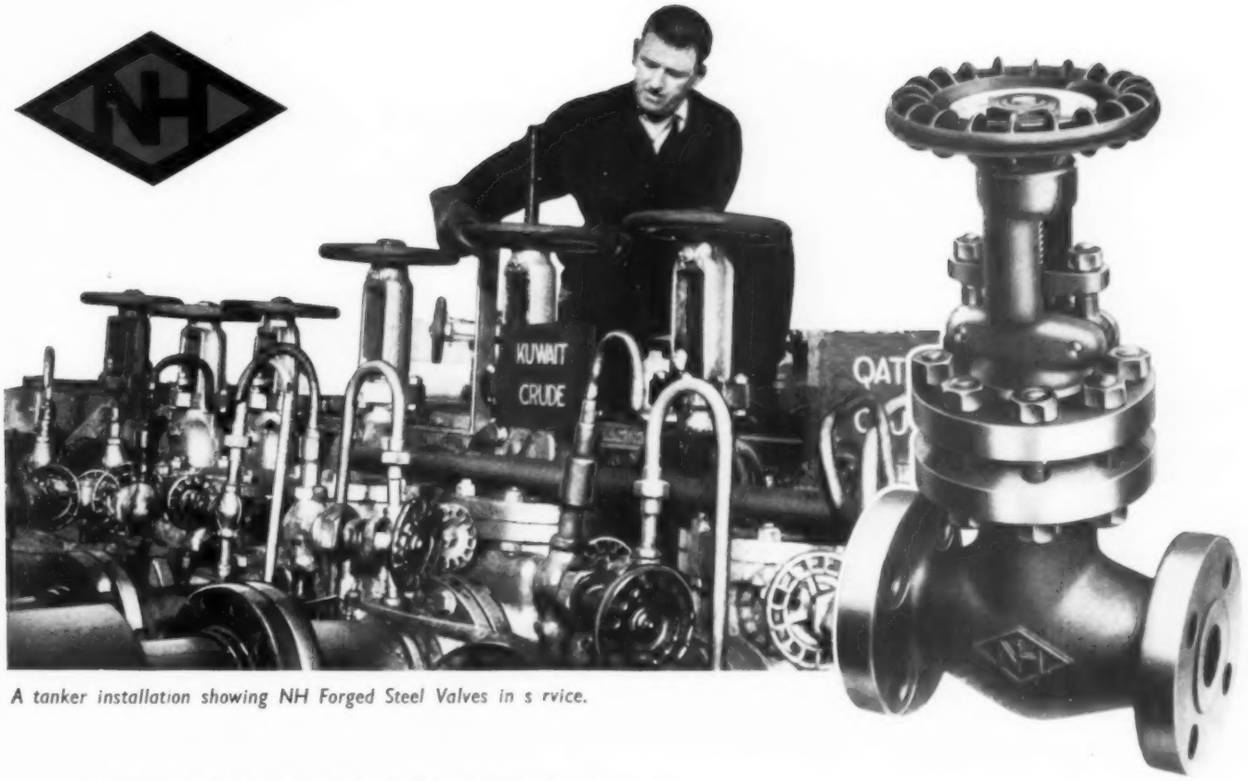

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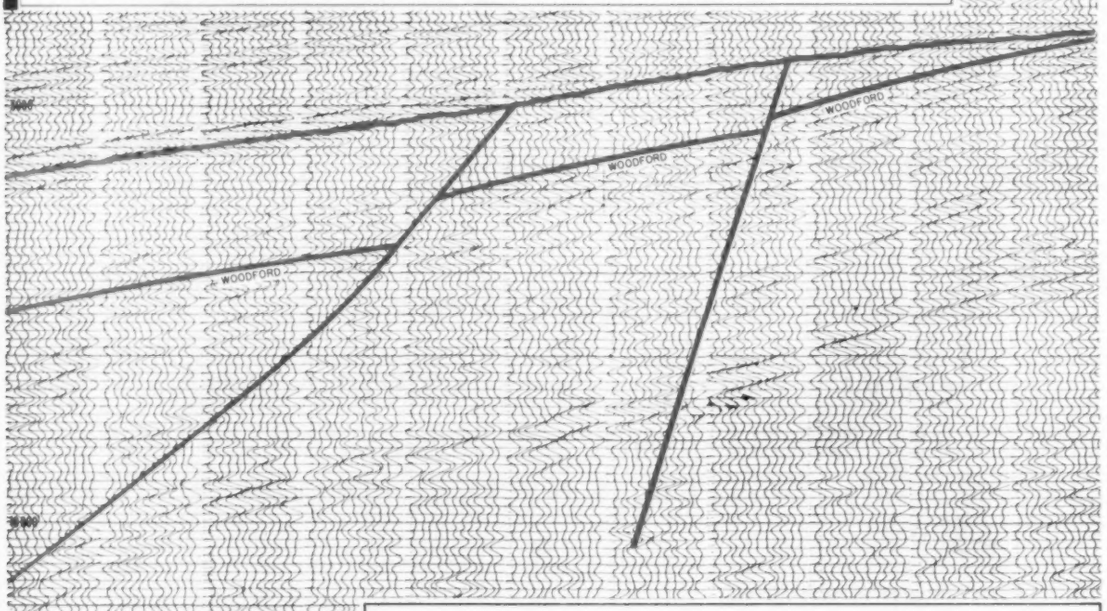

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